ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LIV. No. 25. CHICAGO, SATURDAY, JUNE 19, 1909. ISSUED WEEKLY

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY.
CHARLES W. PRICE, President.
H. S. TUTHILL, Secretary. PHILIP S. DODD, Manager.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: 204 DEARBORN STREET, CHICAGO.

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall.

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The present publication comprises: ELECTRICAL REVIEW, VOL. LIV, No. 25; WESTERN ELECTRICIAN, VOL. XLIV, No. 25.

SUBSCRIPTIONS.

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

Changes of address reaching this office later than Monday cannot be made until the issue next following.

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

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TIME LIMITS AND ELECTRIC RATES.

Whatever system of regular rates may be in force, there is growing recognition of the fact that central stations may profit by the adoption of certain low rates under time limits. Such rates are not necessarily limited to any one class of service or to any particular time of day, but the fundamental reason for their existence is that the electric station is operated at less than full load during most of each twenty-four hours. There is consequently a large amount of generating equipment standing idle most of the time, and the object and effect of the low electric rate with a limit to the hours of its application is to bring this idle machinery into use, together with a corresponding part of the distributing system. In this way a large day motor load, a heating load, a night load of storage batteries, and even an industrial chemical load may be built up.

Rates with a time limit should be adjusted to fit the load curve of each particular station, the tendency being to make the lowest rates for those hours when the demand on the generating equipment is least. The maximum demand of a consumer does not enter as a factor in fixing the rate on a time-limit basis, because the rate is founded on the fact that the station is not loaded during the hours when it applies, but this maximum demand may of course determine the time limits.

Besides the very general influence that the time of rendering each class of service has had in rate making, low specific rates have been applied to various kinds of service on a time-limit basis in many cities, both in Europe and America. At Berlin, Germany, where the variation in different rates is, as a rule, much less than in the United States, the ordinary rate to consumers is 9.6 cents per kilowatt-hour, but under certain conditions the rate of 3.8 cents per kilowatt-hour applies to service between ten o'clock in the evening and seven in the morning. In England the so-called "restricted-hour system of power supply" is receiving an increasing amount of attention and application.

Central stations in some American cities have found it to their advantage to charge storage batteries in large buildings at especially low rates during certain hours of the night, thus preventing the installation and operation of isolated electric plants, and a similar practice appears to be finding wide application as to automobile batteries.

At one time the electric railways of Buffalo were supplied with Niagara energy on a basis that included a time limit, the rule having been that no more than a certain amount of power

would be delivered at certain periods. Where electric supply systems are largely operated with waterpower, it seems that some arrangement like that indicated at Buffalo might often be made with the railways. Contracts of similar nature are often made between hydroelectric systems and their customers, the basis being that power will be delivered only to the extent that water is available.

The pumping of public water supplies into standpipes and reservoirs is a class of work that can only be secured at low rates, but the pumping can usually be done during those hours of the day when electric loads are much below the maximum. Such a plan was applied several years ago to the pumping for a suburban waterworks by the Montreal electric system. Perhaps nowhere else has the time-limit basis of rates been applied so extensively as in Montreal to stationary motor loads, where the requirement has been that large motors be disconnected between 4 and 6 p. m., from September 15 to March 15 of each year, and in this way one of the largest loads of this kind on the Continent has been built up without a corresponding increase of generating equipment.

THE CHEMISTRY CONGRESS IN LONDON.

Probably never before in the history of science has such public recognition and prominence been given in England to the science of chemistry and those who devote their lives to its research and application, as on the occasion of the Seventh International Congress of Applied Chemistry, recently held in London.

It seemed as though royalty, and men and women of eminence in other spheres, were vieing with each other in their efforts to make the *amende honorable* for the cold shoulder which, not so many years ago, British leaders, short-sightedly or unconsciously, gave to scientific men whose researches brought to some other lands industrial gain which they continue to enjoy today.

It has been a matter of more or less continuous complaint that the manufacturer in England has not learned how closely related are applied science and successful industry. Especially have manufacturers as a class been charged with inability to accurately evaluate the services that the chemist has rendered, or is capable of rendering, if he be given the opportunity, in their multifarious processes and operations. It will be remembered that Prof. Stanley Kipping last year pleaded this cause, showing how necessary was the co-operation of the manufacturer and the chemist if British chemical industries were to be prevented from speedily disappearing. The paucity of lucrative openings for young chemists consequent upon the indifferent policy, or want of policy, of the British manufacturer, was said to be rendering chemistry unattractive. Yet one of the most essential things for insuring a progressive spirit in the science and industry of chemistry is an ample and increasing supply of students, for in that way lie fertility and originality of idea.

Possibly the presence in London of so many renowned chemists from all quarters of the globe—"from China to Peru"—may help to alter this state of things. The several thousand delegates were welcomed by the Prince and Princess of Wales at the Albert Hall, a deputation of eminent representatives were received by King Edward at Buckingham Palace, there was a reception on behalf of the Government at the Foreign Office, and a round of garden parties, banquets, and so forth, all of which insured for the proceedings such a measure of publicity in the daily newspapers as would arouse greater interest in minds hitherto careless as to achievements in this particular sphere. The combined effect of all this should add effective weight to the words of Professor Kipping and place the chemist and the man of science generally in that more honored position that he can legitimately claim.

The Prince remarked in his address of welcome that the object of the Conference was to discuss in sections the many topics of interest and importance which are continually arising owing to the marvelous discoveries which the science of chemistry, both pure and applied, is making from day to day; but as he also pointed out, all conferences between scientific men, or men of mind, from other lands could not be other than favorable to the progress of science which played so important a part in almost every branch of modern industry. Those who have attended international congresses connected with scientific or engineering societies have recognized how hearty and how thoroughly genuine is the spirit of fraternization that bubbles over when trained thinkers from different lands meet together to confer regarding matters of deep and common interest between them. The politician and the rabble may be whetting the sword at home ready for a clash of arms, but the spirit of rivalry is never permitted to intrude into the deliberations of those who are seeking out nature's secrets and applying them in the interests of humanity. It is not inconceivable that an international gathering of scientific men might be engaged discussing some new and more dangerous explosive for the destruction of life, with perfect calmness and friendliness, even while an ultimatum was about to be hurled at one of their own nations. The scientific mind may devise the weapons, but the scientific spirit is so international that war it cannot cause.

Such remarks as "without a scientific foundation no permanent superstructure can be raised," and "the rule of thumb is dead and the rule of science has taken its place," require to be urged home upon the minds of the peoples of every manufacturing country, whether they be uttered by the Prince of Wales, or by college demonstrator. On a previous occasion the people of England listened to the words of their prince when they ignored the advice of other competent advisers—it may be that they will listen now with profit and act upon his counsel once again.

There is always a danger of overdoing things on the occasion of a congress in Europe and an accumulation of arrears get deferred or get but scant attention as a result. Regarded from the point of view of the newspaper, things seem in this

case to have been overdone, for the *Times,* toward the end of the congress, gave expression to its impatience that the programme had drifted into an impossible state, and that it was suffering from the great industrial evil of the day—excess of production over consumption. "It is choked with its own waste products, some of which are solid and others gaseous." "Flesh and blood cannot be expected to stand it." So much for the newspaper attitude—perplexed with the multitude of claims of other kinds upon its space—but what of the chemist—he was to be heard confessing the congress a feast of fat things, of wines on the lees. The electrochemical section, like others, seems to have suffered from an embarrassment of riches.

The many subjects of electrical and allied interest that arose for consideration are touched upon briefly as to their salient points, by our contributor (Mr. Kershaw). The outstanding features included the all-absorbing topic of the hour—atmospheric nitrogen, an impressive demonstration of the Birkeland-Eyde process exciting great interest, coal supplies, liquid fuel, while a more than passing interest might profitably be taken in the progress that is being made in the vast land of China in teaching chemical and other science in its schools to its rising generation.

CENTRAL-STATION PROPERTY VALUATIONS.

When a central station operating under the supervision of a State Commission desires to issue new securities or to purchase another plant and its connected business, one of the first points to ascertain is the reasonable value of the property concerned in the transaction. Not infrequently the price agreed upon between the parties in immediate interest is the outcome of a long series of diplomatic negotiations, when the transaction is a purchase and sale. When the issue of securities is planned for the purpose of extending the plant or improving it in some way, it is easier to show a commission the values at stake in the proceedings than when the elements of a trade between companies enter the problem of securing official approval of the agreement which has been reached.

In most cases the price agreed upon when one plant is sold to another is represented by a larger sum of money than the total value of the physical property in question. The book valuations of the plant purchased by no means represent all the money that has been legitimately put into a going concern to establish it, to keep it in touch with up-to-date methods, and to steer its course clear from the rocks of rashness on the one hand and the shallow waters of excessive conservatism on the other. Development expenses, the cost of selling the previous issues of securities, interest during construction, engineering expenses, and the reasonable cost of maintaining an up-to-the-times business should all be considered. The excess of the purchase price over the sum total of the book assets may fairly and easily amount to twenty-five or thirty per cent of the book assets. One makes no mistake in allowing a liberal sum for contingencies in an art subject to the rapid development which pertains to electrical applications. The same sort of reasoning applies to the issuing of securities for physical changes in the plant. Often a company meets these costs for the time being by borrowing money upon its credit, the issue of securities being asked for at a later period when the work is well along toward completion. It is reasonable and fair to ask for a total amount in securities that will provide for contingencies, and not attempt to pare down the estimates to the bare edges of the equipment quotations or even the contract prices.

It is highly desirable, however, when a company appears before a state board in search of its approval of a purchase or security issue, to be prepared with figures showing in a fairly detailed way the make-up of the purchase or the extension cost. The failure to be prepared with a tabulated statement indicating wherein lies the difference between the book values of the property and the agreed-upon prices of costs may cause an entirely well-meaning central-station organization no little annoyance and embarrassment. In a recent case where the purchase price was about two-and-three-quarters million dollars the book values were over half a million dollars less. The difference was reasonable, since the properties which were to be absorbed were all going concerns of long and thoroughly established position in their respective municipalities. Yet the purchaser was not a little handicapped by the absence of specific detailed tabulation of the allowances made for the elements making up the agreed price. When these can be supplied, it not only enables the public authorities to appreciate fully the bases of the estimates, but to some degree compare them with figures and percentages derived from other similar cases. Having detailed information of this character it is then possible for a board which sees the good of the proposed consolidation to meet the inquiries of the public, should they arise, and to explain fully the grounds for its action. From some points of view this course calls for refinements in estimating which are difficult to supply, and yet it is the practice of the best professional engineers, when reporting upon specific projects, to furnish their clients with complete statements showing how the conclusions set forth were obtained. The value of an expert opinion is enhanced by an exposition of its general processes of reasoning, as was clearly demonstrated in the famous Syracuse rate case, where engineers who attempted to appraise equipment without detailed values in mind got into hot water under cross-examination. There is not the least question of the grounds upon which the purchase price of a central-station property in successful business operation may be considerably higher than the sum of the book values; but it is equally certain that the company which goes before a public board of adjudication armed with the unit information upon which the totals are figured will save itself no little delay and possible embarrassment. Even where the resultant prices agreed upon are the outcome of much give and take, and perhaps depend upon many unrecorded conversations, impossible to reproduce, it will pay the petitioning company to have in hand some sort of a subdivided statement of the total purchase price or the cost of improvements proposed or under way.

The New International Unit of Light.

The Bureau of Standards, Washington, D. C., has made the following important announcement of its agreement to an international unit of light that is slightly less than the candlepower now generally used in this country; this value will give the United States identically the same unit of light as that used in Great Britain and France. The official announcement is being made simultaneously in these three countries.

In order to determine as accurately as possible the relations between the photometric units of America, France, Germany and Great Britain, comparisons have been made at different times during the past few years between the unit of light maintained at the Bureau of Standards, Washington; at the Laboratoire Central d'Electricité, Paris; at the Physikalisch-Technische Reichsanstalt, Berlin; and at the National Physical Laboratory, London.

The unit of light at the Bureau of Standards has been maintained through the medium of a series of incandescent electric lamps, the values of which were originally intended to be in agreement with the British unit, being made 100/88 times the Hefner unit.

The unit of light at the Laboratoire Central is the bougie décimale, which is the twentieth part of the standard defined by the International Conference on Units of 1884, and which is taken, in accordance with the experiments of Violle, as 0.104 of the Carcel lamp.

The unit of light at the Physikalisch-Technische Reichsanstalt is that given by the Hefner lamp burning at normal barometric pressure (seventy-six centimetres) in an atmosphere containing 8.8 litres of water vapor per cubic metre.

The unit of light at the National Physical Laboratory is that given by the ten-candlepower Harcourt pentane lamp burning at normal barometric pressure (seventy-six centimetres) in an atmosphere containing eight litres of water vapor per cubic metre.

In addition to the comparisons of electric and flame standards carried out recently by the national laboratories in Europe, one comparison was made in 1906, and two in 1908, between the American and European units by means of carefully seasoned carbon-filament electric standards, and as a result of all the comparisons the following relationships are established between the above units:

The pentane unit has the same value within the errors of experiment as the bougie décimale. It is 1.6 per cent less than the standard candle of the United States of America, and eleven per cent greater than the Hefner unit.

In order to come into agreement with Great Britain and France, the Bureau of Standards of America proposed to reduce its standard candle by 1.6 per cent, provided that France and Great Britain would unite with America in maintaining the common value constant, and with the approval of other countries would call it the International candle. The National Physical Laboratory, London, and the Laboratoire Central d'Electricité, Paris, have agreed to adopt this proposal in respect to the photometric standardization which they undertake, and the date agreed upon for the adoption of the common unit and the change of unit in America was April 1, 1909.

The following simple relations will therefore hold after that date:

1 International Candle = 1 Pentane Candle.

1 International Candle = 1 Bougie Décimale.

1 International Candle = 1 American Candle.

1 International Candle = 1.11 Hefner Units.

1 International Candle = 0.104 Carcel Unit.

Therefore 1 Hefner Unit = 0.90 International Candle.

The pentane and other photometric standards in use in America will hereafter be standardized by the Bureau of Standards in terms of the new unit. This, within the limits of experimental error, will bring the photometric units for both gas and electrical industries in America and Great Britain and for the electrical industry in France to a single value, and the Hefner unit will be in the simple ratio of 9/10 to the international candle.

The proposal to call the common unit of light to be maintained jointly by the national standardizing laboratories of America, France and Great Britain, the "International Candle" has been submitted to the International Electrotechnical Commission, which will endeavor to secure the indorsement of the proposal by all countries of the world which are represented on that Commission.

It is hoped that such general approval may be secured, and that in the near future the term "International Candle" will receive general sanction.

The above announcement marks an important step forward in the history of photometric measurements. For many years the British parliamentary candle was the unit recognized in this country, but the lack of precision in practical photometry did not permit its value to be very accurately expressed or reproduced. In recent years the gas industry has employed the one-candlepower sperm candle, the ten-candlepower Harcourt pentane lamp, the Hefner lamp, and various secondary standards, while the electrical industry has employed incandescent electric lamps either certified by the Bureau of Standards or rated in terms of standards that are consistent with those of the Bureau. The unit of the Bureau has been maintained very constant, as shown by frequent comparisons with the standards of France, Germany, and Great Britain, but differed appreciably from the British unit and hence from the unit employed by most of the gas companies in America.

The Bureau of Standards took the initiative several years ago in bringing about international uniformity in the unit of light by sending its representatives abroad with copies of its standards to determine more accurately the relative values of the units of the several European countries and to urge the adoption of an international unit. In this country the American Institute of Electrical Engineers, the American Gas Institute, and the Illuminating Engineering Society have acted together in support of the movement, and have voted in advance to recognize the new unit of candlepower.

In England the National Physical Laboratory has secured the indorsement of the London Gas Referees and the Institution of Gas Engineers.

The union of the three national standardizing institutions of America, France, and Great Britain in maintaining a common unit of candlepower, and the cooperation of the German Reichsanstalt in redetermining, from time to time, the ratio of the Hefner unit to the common international candle, assures the highest attainable constancy, for the new unit of light.

Unfortunately there is no primary photometric standard that is sufficiently constant and reproducible to be generally accepted as an international standard. France, Germany, and Great Britain each has its own primary flame standard, and a great deal of effort has been expended in attempting to determine accurately the relations between them. Until the flame standards themselves are better understood, however, and the atmospheric and other conditions more perfectly controlled, the unit of light cannot be preserved as accurately by primary flame standards as by incandescent electric secondary standards. The latter, when well made, properly seasoned, and carefully measured, permit comparisons to be made (using the means of many settings on several lamps) with excellent precision, the lamps themselves being constant enough and the precision of measurement high enough to fix the final values to about one or two tenths of one per cent. There is good reason to believe that in this way the international unit of light can be preserved so nearly

constant that any inevitable drift occurring one way or the other would be too small to detect with certainty by any of our present flame standards in many years. The Bureau of Standards will continue to standardize flame standards by the electric standards and will also carefully investigate the more important flame standards. Similar tests and investigations will also be made in Europe, and if any appreciable drift does occur it will sooner or later be detected.

Careful distinction should be made in this connection between a unit and a standard. An international unit maintained by the co-operative effort of several national standardizing institutions, and checked from time to time by means of all the best primary standards in use, is more likely to be maintained constant than if it were defined to be represented by any single primary standard, unless such a primary standard were reproducible to a very high degree of precision. Such a unit can be continued permanent even though all present primary standards are ultimately superseded by better ones. The Hefner lamp as a convenient flame standard will not be displaced in America or any other country which adopts the international candle as its unit of light. Uniformity among different countries and continuity of value are prime necessities with respect to the unit. But the particular standard by which the unit is realized in practice is largely a matter of convenience and circumstance. In the photometry of electric lamps, electric standards are most suitable. In gas photometry one form of flame standard or another will be employed according to circumstances. It is not expected that all countries of the world will at once adopt the proposed international candle as their unit of light. Those countries which already have the Hefner unit in general use may prefer to continue it. But if all countries which have a unit differing appreciably from the Hefner shall adopt the international candle as their unit, there will then be only two units in use throughout the world, and they will have the simple ratio 9:10. This would result in a distinct gain both in the practice of photometry and in definitions and nomenclature.

The effect of this change of 1.6 per cent in the unit of the Bureau, which is in general use for electric lighting throughout the country, is to raise the candlepower rating and decrease slightly the watts-per-candle of electric lamps. A sixteen-candlepower lamp will give 16.26 candles in the new unit, or a sixteen-candlepower carbon-filament lamp burning at 110 volts will give sixteen candles on the new basis at 109.69 volts. The change, though small, is important in the photometry and rating of lamps.

The new unit of candlepower being in agreement with the present English unit as represented by a ten-candlepower standard pentane lamp, there will be no change in the unit of light now employed by those gas companies which use pentane lamps, provided they are in agreement with the English standard. But as pentane lamps may differ slightly from one another, even when burned under the same conditions, it is desirable for the sake of greater uniformity to have them standardized in terms of the standard candle of the Bureau. These variations, amounting to from one to five per cent, are generally in the same direction; that is, the lamps if not correct usually give less than ten international candles under standard conditions when burning in a pure atmosphere at a normal barometric pressure of seventy-six centimetres of mercury and an atmospheric humidity of eight litres of water vapor per cubic metre. In anticipation of this change some of the largest gas companies in the United States have already had their pentane and Hefner standard lamps standardized by the Bureau in terms of the new unit.

Gas standards will hereafter be certified in terms of the international candle. Electric standards will be certified in terms of the old unit until July 1, 1909, unless otherwise requested. On July 1 the new unit will be adopted by the Bureau of Standards in the certification of electric standards, and it is hoped that manufacturers of electric lamps will adopt the new unit as soon thereafter as possible.

The Bureau recommends that all gas and electric companies, all photometric laboratories and all the manufacturers of electric lamps in the United States adopt the new unit of candlepower, if possible, not later than January 1, 1910.

Tariff On Carbons.

By an amendment to the tariff bill which is to be introduced by Senator Burton, it is proposed to place a duty of thirty-five per centum ad valorem on all importations of electrodes, brushes, rods, plates, and disks, when they are composed wholly or in chief value of carbon.

To Protect Power Sites.

Acting upon the specific instructions of the Secretary of the Interior, the United States Geological Survey has begun the investigation of waterpower sites on the public lands. Since April 28, the date of the secretary's order, the director of the Survey has recommended eleven temporary withdrawals "in view of proposed legislation affecting the disposal of the waterpower sites on the public domain." These power-site withdrawals, aggregating 236,365 acres of public lands in the states of Utah, Colorado, Wyoming, Montana, Idaho and Oregon, have been approved by Secretary Ballinger.

The present policy is to protect the public interests on the one hand by promptly withdrawing from all entry all public lands containing possible power sites, and on the other hand, by excluding from such withdrawals as far as information at hand warrants all area of no value for power purposes, but properly disposable under the agricultural and other public land laws.

The director of the Geological Survey has assured the secretary that the temporary withdrawals of waterpower sites already made from data in the possession of the Survey, together with such as will hereafter be made prior to the convening of Congress, will be ample to protect all the more important waterpower sites undisposed of on the public domain and enable Congress to legislate intelligently for their disposition.

New Haven Electrification.

W. S. Murray, the electrical engineer and assistant to Vice-President McHenry, of the New York, New Haven & Hartford Railroad Company, testified before Mr. Eustis, of the New York Public Service Commission on June 12, that it was the intention of the company to electrify its entire line from New York to New Haven. The electric zone now runs only to Stamford, Conn., a distance of twenty-two miles, over which there is a four-track road.

Mr. Murray also stated that the company intends to electrify its Harlem River branch, which runs from the Harlem River, near Port Morris, through West Farms and Pelham Bay Park to New Rochelle, where it joins the main line. The company now has a power house at Cos Cob, but will probably erect another to supply the current for the Harlem River branch. It will take from twelve to eighteen months to complete the electrification of this branch.

THE DESIGN OF STEAM-ELECTRIC POWER PLANTS.

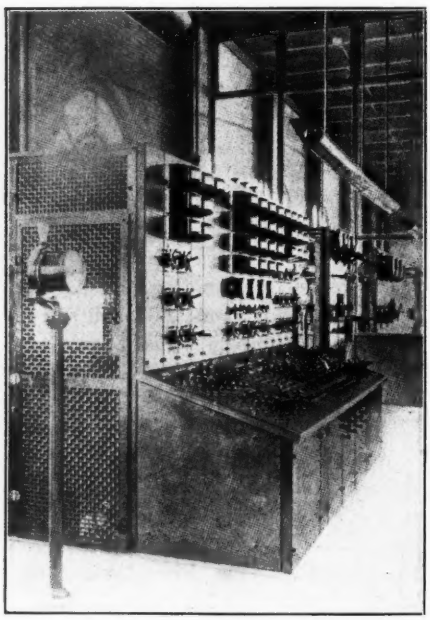
BY FRANK KOESTER.

ELECTRICAL EQUIPMENT.

As has been said of the mechanical equipment, the electrical equipment must also be designed on the unit system. To simplify the operation of the entire plant each generator must have its own panel on the switchboard, its own exciter, etc.

The electrical characteristics of the generator, particularly its capacity, voltage and frequency, depend upon the transmission and service requirements.

In determining the capacity of the exciters the number to be used must be carefully considered. A single exciter unit of sufficient capacity should not be installed. A division into smaller units should be made, so that, in case of breakdown, the whole plant may not remain idle, while repairs are being made to one exciter.



REMOTE-CONTROL SWITCHBOARD, PORT MORRIS PLANT, NEW YORK.

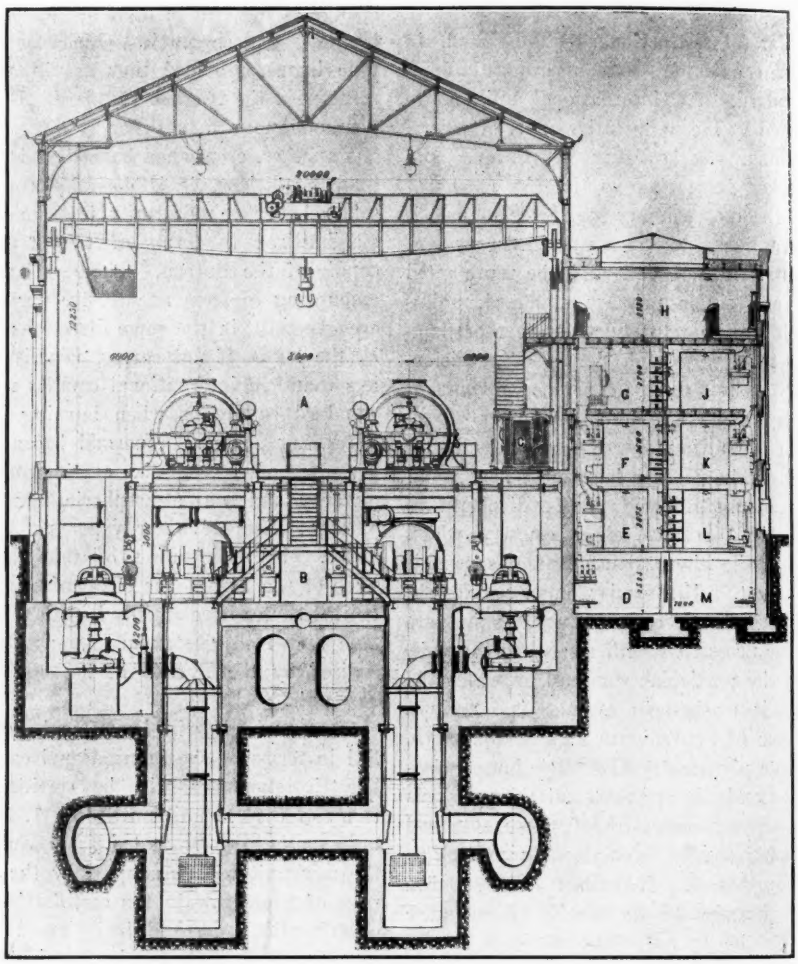
The capacity of the exciter units varies from one-half to two per cent of the total output of the plant; for example, a plant of 20,000 kilowatts normal capacity should have preferably two 100-kilowatt exciters. The exciters may be either steam or motor-driven, or a combination of both, in which case the steam drive is used for starting, while the motor exciter is used after the plant is in operation.

Care must be taken to study the actual requirements for switchboards before the dimensions of the plant are determined, as it happens too often that the space allotted for switchboards is found too small, and it becomes necessary to crowd all apparatus to such an extent as to make access to it difficult.

Busbar chambers, oil switches and switchboards, etc., may be located on separate floors. A good example of this will be found in the Fifty-ninth Street Station, New York, where the main buses are located on the lowest floor, the oil switches on the floor above and the switchboards on the upper floor. No high-tension voltage (11,000) reaches the upper floor, as all oil switches are operated by low-tension remote-controlled current.

Another station, considered from this standpoint, is the Waterside Station No. 2, also in New York. Here the main controlling apparatus is located in the switching room on the same level as the main generator floor. The five floors above containing different apparatus are as follows: First, auxiliary and main buses; second, selector switches; third, high-tension feeders; fourth, automatic oil switches; fifth, the racks carrying the controlling cables. From this it will be seen that the high-tension cables must pass all floors going up on one side wall and down on the other.

For the purpose of illustrating European practice there is given herewith a cross-section of the St. Denis plant, Paris, which shows the arrangement of the switch house. It will be noticed that the various classes of apparatus are kept in separate rooms, starting in compartment D, which contains the generator leads; the current flows in alphabetical order, from one compartment to another, the apparatus being placed as follows: E, main generator switches; F, the main busbars; G, rheostats; H, taking the entire upper floor, contains the controlling bench board and the low-tension switchboards. No high-tension current passes into the upper compartment but is carried across to compartment J, where are lo-



CROSS-SECTION OF TURBINE ROOM AND SWITCH HOUSE, ST. DENIS PLANT, PARIS.

cated the feeder switches. Compartment K contains the busbar junction switches, while L contains the potential regulators. The last compartment, M, serves for the outgoing cables.

The practice in America and Great Britain is to place busbars and oil switches in compartments made up of brick or concrete, and in some instances concrete blocks have been employed. The oil switches are of the remote-controlled type, being operated by motors from the main controlling bench.

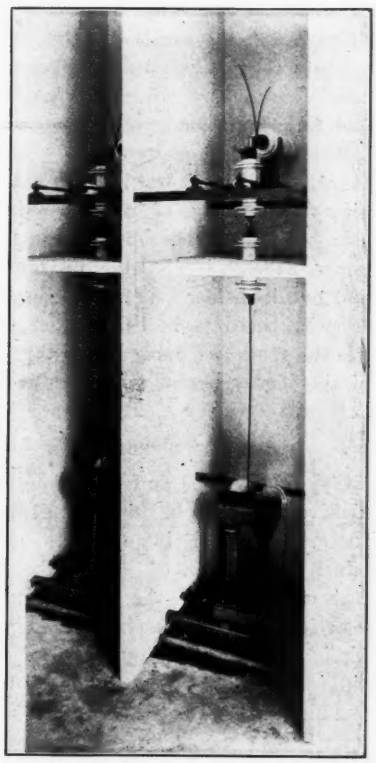
In the modern European practice the busbars are not placed in compartments, but simply arranged in an exposed position on both sides of an aisle. The oil switches, fuses, etc., are placed in concrete cells without front covering. The high-tension oil switches are usually operated by hand.

Another departure, on the Continent, from the ordinary switchboard practice, is the use of pedestals for mounting instruments and operating levers. This applies particularly to Switzerland. Usually a pedestal is provided for each generator and exciter and contains the necessary instruments and levers for each individual machine. These pedestals are located centrally in the switchboard gallery and have the advantage that the operator attending faces the generating room instead of having his back turned thereto, as is the case with the more common switchboards.

Of late years control benches have come into considerable favor. They are used chiefly for controlling the main oil switches both for the generator and outgoing feeders. They are equipped with pilot switches and lamps for operating the main circuit-breakers, field switches, field rheostats, governor motors, etc. These benches are usually placed in front of the instrument board, and must be so arranged that the panel of one circuit is directly behind the section of the same circuit on the controlling bench. To further facilitate operation, the panel and control bench are provided with card holders or name plates to classify the groups. In addition to this dummy busbars are frequently shown on the bench.

A novel feature in low-tension[1] alternating-current switchboard design, in use only a few years on the Continent of Europe, is the wagon-panel system. It consists of mounting either a part or the entire panel on a carriage. Such a carriage as constructed by the Siemens-Schuckertwerke of Germany is shown in an accompanying illustration; it consists of a carriage running on small wheels upon the structural steel frame of the switchboard and carries the panel with all the instruments. When a panel is to be removed it needs merely to be unlocked and pulled out (each panel is provided with two handles). The electrical connections do not have to be disturbed, as they are made similar to a knife-blade switch, that is, by means of heavy clips which make and break the circuit when the carriage is rolled in or out. The wagon is so provided with locking

SIEMENS-SCHUCKERTWERKE WAGON-PANEL SWITCHBOARD SYSTEM.



OERLIKON WATER-FLOW GROUNDERS AND HORN LIGHTNING ARRESTERS.

[1] To the writer's knowledge they have been installed up to 3,000 volts.

switches, that it cannot be withdrawn while the panel is in operation, which is particularly essential for high-tension switchboards. The principal advantage of this wagon-panel system is that a panel can be withdrawn for inspection and repairs, and that a reserve panel can replace a damaged one without disturbing the operation of the remaining units. Thus the danger otherwise encountered in making repairs on the switchboard is eliminated.

Switchboards and controlling benches are made of structural steel or pipe frames faced with white or blue marble or slate slabs. The marble presents a much finer appearance but readily shows oil stains and scratches, and if the board is extended at any future time it is difficult to match the panels. White marble is chiefly used in isolated plants and in central stations in Europe, where the panel frames are made very ornate.

In most American electric plants, slate with dull black or oil finish is used. It has the advantage of having a uniform shade, while scratches and oil spots are readily eradicated, also the instruments stand out in bolder relief. The back of the switchboard must be at least from three to four feet away from the wall and thoroughly braced at the botom and top.

POWER PLANT PROTECTION.

Many of the large central stations have extensive aerial transmission and distribution systems, and in order to guard against interruption of service, the electrical equipment of the same must be protected against atmospheric discharges. This is done by providing the plant with lightning arresters or some form of grounding device which acts as a relief vent.

Various sources of disturbances, particularly lightning where the transmission line runs through sections of country of different altitudes, cause surges and oscillations in the circuit of such frequencies and high potential that they would endanger the electrical equipment either at the generating station or substation or probably both.

In general, a lightning arrester is made up of three elements, viz., an air gap, a current-limiting element, and an arc-suppressing device. These features are embodied in the horn type, multigap type and electrolytic lightning arresters. The two former are well known and hardly need any discussion. The latter is a newer type, generally known as the aluminum cell arrester, in which the components are submerged in a steel tank or porcelain jar. A series of concentric aluminum pans are placed one above the other and separated by an electrolyte, usually a borax solution.

In Europe the waterflow grounder is very much used to take care of light surges. This apparatus consists of a nozzle or jet of water flowing downward or upward against a baffle plate connected to the line. The streams are usually three-eighths of an inch in diameter, allowing a leakage of 0.1 of an ampere. The water is supplied from the water mains or by a spring or by a centrifugal pump, in the latter case an elevated storage tank must be provided to give the stream a uniform flow. In many cases the water used in water-cooled transformers is used for this purpose.

The fluid arresters are always used in connection with horn arresters or multigap arresters or both, which take care of the heavier lightning discharges.

EFFICIENCY.

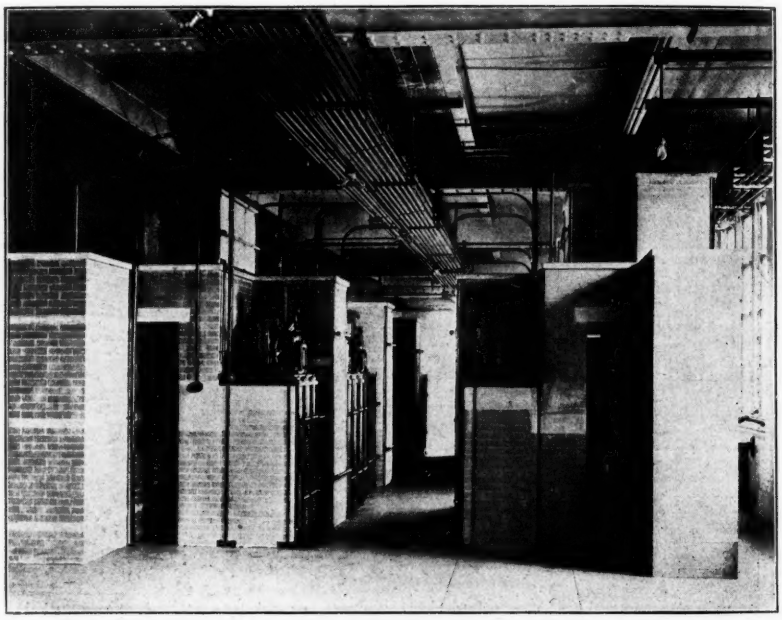
The efficiency of steam-electric power plants is low, ranging from eight to sixteen per cent of the heat value of the coal. Sixteen per cent is extremely economical, and can only be secured by the best designed and equipped plant, and by scientific operation. The average plants of recent construction operate with an efficiency of from ten to fourteen per cent. The following table shows the approximate loss per pound of coal in a well-conducted first-class power plant. It will be noted that the coal is assumed to have a heating value of 14,000 British thermal units, of which an equivalent of 12.8 per cent or 1,792 British thermal units are delivered to the busbars.

APPROXIMATE LOSS PER POUND OF COAL IN A WELL-CONDUCTED, FIRST-CLASS STEAM-ELECTRIC POWER PLANT.

Subject.	Loss in B. T. U. and Percentage per Pound of Coal. 1,400 B. T. U.	100 %.
Ashes	210	1.5
Radiation and leakage of boiler.	560	4.0
Radiation and leakage of flue..	140	1.0
Gases through chimney.....	1,960	14.0
Blow-off and leakage.....	210	1.5
Radiation and leakage of piping.	210	1.5
Friction and leakage of engine.	140	1.0
Rejected to condenser.....	8,540	61.0
Electrical loss.....	28	0.2
Required for all auxiliaries.....	910	6.5
	12,908	92.2

Returned by feed-water heater, 5%, or 700 B. T. U.

Delivered to busbars, 105 — 92.2 = 12.8%, or 1,792 B. T. U.



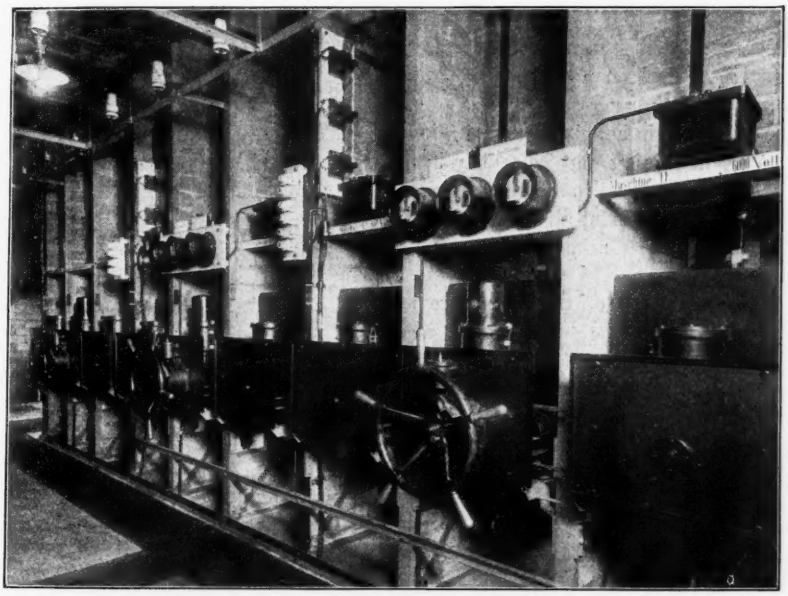
OIL-SWITCH COMPARTMENTS, LONG ISLAND CITY PLANT.

CONCLUSION.

The first cost of a power plant depends upon its character and the equipment, as well as upon the superstructure. In other words, the ability of the plant designer is of the utmost importance. Another important factor is the location of the plant, as well as its size. With the increase in size of plants the cost per kilowatt is reduced. Small plants up to 5,000 kilowatt capacity have been installed in the West at from $110 to $140 per kilowatt, while medium size and large plants have been built at from $70 to $90 per kilowatt. In the East plants are more expensive, owing to the higher cost of labor. The average cost in the East of medium and large size plants, depending upon the equipment, runs from $80 to $100 per kilowatt, although in excep-

tional cases the cost has been as high as $125 and even $150 per kilowatt. On the other hand large plants have been installed at as low a cost as $65 to $70 per kilowatt, such being exceptional cases and accompanied by favorable conditions throughout, viz., low cost of excavation, foundations and building as well as the favorable purchase of equipment and careful design of the whole plant.

The following tables are average figures of the several items. It will be noticed that the first tables have been computed for plants equipped with 4,000 to 5,000 kilowatt units, both for the reciprocating engine and turbine, while the last table gives average figures for plants with units from 500 to 1,000 kilowatts. A is the cheapest possible construction, B the more expensive one.



SWITCH GEAR IN A BERLIN PLANT.

COST IN DOLLARS PER KILOWATT OF PLANTS EQUIPPED WITH TURBINES, 4,000 TO 5,000 KILOWATT UNITS.

	A.	B.
Excavation and foundation	$ 2.00	$ 2.50
Superstructure	10.00	15.00
Condensing water tunnel	1.75	4.00
Flues and chimneys	2.50	3.50
Boilers and stokers	8.50	12.00
Superheaters	2.00	2.50
Feed water heaters	2.00	2.25
Coal and ash conveyers	1.50	3.00
Forced-draft system	1.00	1.50
Pumps and water tanks	1.00	1.25
Piping	2.25	4.50
Turbo-generators	22.00	25.00
Surface condensers	7.00	10.00
Exciters	.75	1.00
Switchboard	2.00	3.50
Crane	.25	.50
Miscellaneous	1.00	2.00
Total	$67.50	$94.00

COST IN DOLLARS PER KILOWATT OF PLANTS EQUIPPED WITH RECIPROCATING ENGINES, 4,000 TO 5,000 KILOWATT UNITS.

	A.	B.
Excavation and foundation	$ 3.00	$ 5.00
Superstructure	10.00	20.00
Condensing water tunnel	1.50	2.75
Flues and chimneys	2.50	2.75
Boilers and stokers	8.50	12.00
Superheaters	1.75	2.25
Feed water heaters	2.00	2.25
Coal and ash conveyers	1.50	3.00
Forced-draft system	1.00	1.50
Pumps and water tanks	1.00	1.50
Piping	2.50	5.00
Engines	18.00	22.00
Jet condensers	5.00	8.00
Exciters	.75	1.00
Generators	10.00	12.00
Switchboard	2.00	3.50
Crane	.25	.50
Miscellaneous	1.00	2.00
Total	$72.25	$107.00

COST PER KILOWATT CAPACITY OF SMALL PLANTS EQUIPPED WITH 500 TO 1,000 KILOWATT UNITS.

Excavation and foundation	$ 5.00
Superstructure	30.00
Condensing water tunnel	2.50
Flues and chimneys	3.00
Boilers and stokers	14.00
Superheaters	2.00
Feed water heaters	2.00
Coal and ash conveyers	3.25
Forced-draft system	1.75
Pumps and water tanks	1.50
Piping	4.00
Prime movers	23.00
Condensers	8.75
Exciters	1.25
Generators	12.00
Switchboard	2.50
Crane	.50
Miscellaneous	3.00
Total	$120.00

Programme for the Ohio Electric Light Association's Convention.

The fifteenth annual convention of the Ohio Electric Light Association will be held in the city of Toledo, Ohio, on Tuesday, Wednesday and Thursday, July 13, 14 and 15. The headquarters of the association and its sessions will be in the famous Boody House, where the most successful conventions of the association have been held in the past. The convention this year is to be held one month earlier than past dates. This was done in order to accommodate station men and avoid the rush season of August.

The programme for this year's gathering will be a practical one. The number of papers will be limited in order to give ample time for the discussion of the subjects. The papers will be upon the following topics:

"Residential Lighting," "The Supplying of Electric Current to Other Towns from a Centrally Located Station," "Engine-Room Management," "The Commercial Organization of Electric Lighting Companies and Their Relation to the Public," "Boiler-Room Economy," "Factors to be Considered in Making Street Lighting Contracts," "Plans to be Followed in Supplying Lamps to Consumers," "The Titanium Arc Lamp" and "Tungsten Lamp Experience." Upon some of these topics more than one paper will be presented.

The entertainments provided for all attending will be more extensive than ever before. The souvenir programme, issued by the association itself, has progressed far enough to assure its financial success.

Tuesday—Auto ride for the ladies; trip to Casino, with 6 o'clock dinner and theatre party for all. Wednesday—Trip to Fort Meigs for the ladies; trip to Toledo Beach, with frog-leg dinner and ball for all. Thursday Afternoon—Trip to Cedar Point, Ohio, with banquet, lagoon ride and ball in the evening. Transportation in the city and to Cedar Point, and the dinners, banquets, rides, balls and all other features of the entertainment will be free to all attending.

The association has provided an exhibit room, forty by seventy, in the Hotel Boody for the free use of associate members and others desiring to make an exhibit. Application for space should be made to the secretary of the association, D. L. Gaskill, Greenville, Ohio. Ample supply of single-phase, 115 and 230-volt sixty-cycle current is available in the exhibit room. If the demand justifies the light company will supply three-phase current at the same voltages.

Hotel rates at the Boody for the convention will be: European plan, $1 to $2.50 per day; American plan, $2.50 to $5 per day. However, the convention furnishes the evening meals of Tuesday, Wednesday and Thursday. Reservations for rooms should be made directly with the Boody House Company.

Testing of Central Station Transformers.

In the issue of May 29 an article entitled "Testing of Transformers in Central Stations," by Omer F. Dubruiel, appeared. Investigation has developed that this material has been taken almost bodily from bulletin 5016, published by the Fort Wayne Electric Works, Fort Wayne, Ind.

Meeting of the Central Electric Railway Association.

The regular bi-monthly meeting of the Central Electric Railway Association was held in the Anthony Hotel, Fort Wayne, June 3. A number of special cars, filled with members and invited guests, came from Louisville, Cleveland, Dayton, Indianapolis, Toledo and Detroit.

The meeting was called to order by A. A. Anderson, president.

The report of the secretary showed that twenty-six new members had joined the association since the last meeting.

The first paper was by J. A. Gohen, of the Clenola Company of Indianapolis, on "Piecework." In considering the practicability of piecework in interurban service, Mr. Gohen said that experience would sustain the assertion that piecework, if properly conducted, makes better and more diligent workmen than day work. About all the average day worker seems to consider is that the company has agreed to pay him so much for so many hours per day, whether he does or does not give commensurate service. Under the piecework system, the ambitious man becomes a co-partner of his employer, and is remunerated for any increased efforts on his part. Mr. Gohen set out the lines of work that could be done by piecework and exhibited a schedule of prices for each division.

President Anderson, in opening the discussion, said he was not familiar with the piecework plan in a general way, but admitted that it seemed to be both feasible and economic. Mr. Spring and Mr. Shelton said they had had experience with the piecework plan in the shops in the repair and assembling of cars, but doubted if the work of a shop could be carried on in its entirety under the piecework system.

Mr. Gohen closed the discussion by saying he was a convert to the system, and also answered very satisfactorily the many questions asked. He said it was the more rational method of paying for labor, because the underlying principle required the employes' co-operation in the business and prevented labor unions demanding that good and indifferent workmen be paid a similar wage.

The afternoon session was opened by the reading of an interesting and instructive paper on the "Accounting Department," by W. B. Wright, auditor of the Indianapolis & Cincinnati Traction Company.

At the conclusion of the programme President Anderson read an invitation from the Mayor of Dayton, Ohio, asking the members of the association to the Wright Brothers' home-coming celebration in that city June 16, at which their flying machines would be demonstrated.

The members and visitors were then taken on special cars to the Spy-Run power house, operated by the Fort Wayne and Wabash Valley Traction Company, as the guests of M. J. Kehoe, superintendent of the company, who acted as guide and instructor.

It was decided to hold the next meeting at Detroit, August 26. The time for the regular fall meeting would be September 27, but on account of September being a busy month with the interurban lines it was thought best to have the meeting a month earlier. S.

Progress of Electric Mine Pumping.

Cornwall, the most southwesterly county of England, has been producing tin from prehistoric times, and even now is quite a factor in the tin supply of the world.

The art of mining may be said to have originated in Cornwall, and Cornish miners have been prominent all over the world in developing the mineral resources of other countries.

In the beginning of the steam age in the early part of the last century, and indeed up to quite recent times, Cornwall was always to the front in adopting the latest methods in the development of her mines, and was identified in many ways with the evolution of the steam engine. The old Cornish pumping engine, with its wonderful efficiency, speedily attained a pre-eminence which it held undisputed for many years.

It comes then almost as a shock to hear that in this conservative old English county, electricity has at last obtained such a foothold as to threaten the very existence of the old Cornish engine.

At a recent general meeting, the directors of the premier tin mine of the county announced that after prolonged and anxious consideration, the joint recommendation of the mine manager and a firm of consulting electrical engineers to drive the pumps and stamps by electric motors had been adopted. This was in spite of the fact that some previous applications of electricity in Cornish mining have proved unsuccessful.

In this particular mine it was found that the installation of a Cornish pumping engine would cost more than an isolated electric plant, and that a capital expenditure of $100,000 would be saved by taking power from an electric supply company, with the operating cost about the same, or even less than at present. The mine manager recommended the use of duplicate pumping sets to insure reliability.

Now that electricity has gained such a strong footing in Cornwall, the complete displacement of the steam engine by the electric motor is only a matter of time, and the next steady rise in the price of tin should bring all the larger mines into line with the march of modern progress.

The Advantages of Electrification.

A leading Boston electrical engineer is quoted as follows in the *Wall Street Journal:* "It has become the fashion to harp upon the excessive cost of steam-railroad electrification. It is time that the other side of the story were told. One great advantage is the low cost of locomotive maintenance. In a hilly country on a two per cent grade it costs fourteen cents per car-mile for steam-locomotive maintenance. The cost of electric-locomotive maintenance will not exceed four cents per car-mile, and the electric locomotive can take a two per cent grade at twenty-five miles per hour, where a steam locomotive could hardly do half that speed. The cost of stopping an electric locomotive is hardly ten per cent of that of stopping a steam locomotive.

"Another saving is in the longer continuous run which the electric locomotive can make. The New York Central, for example, thinks nothing of running its electric locomotives on continuous stretches of 2,000 miles without having them hauled up for inspection or repairs. No steam locomotive could possibly do this, and on through trains locomotives are changed every 150 or 200 miles, as the case may be."

The Philadelphia Section, American Institute of Electrical Engineers.

The annual social meeting of the Philadelphia Section of the American Institute of Electrical Engineers was held on Wednesday evening, June 2, at the Pointsettia Hotel, Atlantic City, N. J. A large number of members and guests were present, and covers were laid for 100. Paul Spencer presided, and among the others present were Ralph W. Pope, secretary of the American Institute of Electrical Engineers, Professor Rowland of Drexel Institute, Professor Hoadley and Dr. Allerman of Swarthmore College, and Professor Franklin, of Lehigh University.

The Patent System in Its Relation to Industrial Development.

At the twenty-sixth annual meeting of the American Institute of Electrical Engineers, New York, May 18 last, Frederick P. Fish read a paper on "The Patent System in Its Relation to Industrial Development." Mr. Fish commenced his paper with a short but comprehensive history of patent-law development, with especial reference to the patent system of Great Britain. This latter was the only one that had received any development before our own. Its object was to promote progress, primarily by encouraging the establishment of new industries in Great Britain or the improvement of those already established. The English patent law, from the beginning, was construed as affording to one who brought into England an industry or an improvement from a foreign land, a right to the same protection as that to which he would be entitled if he had been the inventor or the discoverer of that industry or that improvement.

This has been a characteristic of many of the important patent systems that have been developed in countries outside of the United States and England. In great part they take the English view. For the first time in the world, the framers of our constitution laid the entire stress of their effort on the recognition and reward of inventive thought. They believed that there was no way so effective of securing new industries or of making improvements in old industries, as to encourage intellectual effort by way of invention and discovery. They authorized only a single reward, a single recognition of the inventor's merit, namely, that there should be secured to him the "exclusive right" to his invention for a limited time.

Our scheme of patent protection amounts simply to the grant to one who has had the intelligence and skill to make an improvement in the useful arts which involves invention, of the exclusive right, for the term of seventeen years, to make, use and sell that which he has discovered, invented or designed. The patentee may sell the entire patent. He may sell a part interest in the patent. He may grant licenses in any form he chooses to any number of people, provided his licenses are consistent with each other. He may give one a right to use only; another a right to manufacture and sell. He may give to one a right, exclusive or non-exclusive, to apply the invention in one field, and to another an equally valid right, exclusive or non-exclusive, to apply it in another field.

The cost of taking out a patent is not great, and once the patent is granted there is no further expense for the seventeen years during which it is in force. Nor is the patentee obliged to work under the patent or to make any use of his invention at all unless he chooses. In these respects the United States patent law is far more liberal on the whole than that of any other country. In some countries the inventor has to pay periodical fees under penalty of forfeiture. In some countries, too, the patent will be forfeited if it is not worked within a limited time, which period of time may well elapse before the art is ready for the invention or before the invention is commercially perfected, or before capital can be secured for its development. Again, the owner of the patent may be forced to grant licenses the terms of which are fixed without his consent, thereby depriving him to some extent of the possibility of the profitable exploitation of the patent. These restrictions are, in the author's opinion, entirely wrong in principle and tend to hinder the progress of the useful arts.

Although our American patent system is free from these drawbacks, the administration of it in the Patent Office and in the courts involves many difficulties and annoyances. It would seem, that in order to avoid the present conflict in judicial decisions, an intelligent and well-directed effort on the part of the patent bar and the courts could bring about a much-needed reform in the present cumbersome and expensive methods of taking testimony in patent cases. The uncertainty in the application of the law to the facts, which obtains especially in patent cases, makes it a difficult matter to foresee how a patent will be viewed and construed by the courts, and leads to more or less conflict in judicial decisions. This is most unfortunate and should be remedied if possible. The substitution of a single Appellate Court to replace the nine independent courts of appeal would go a long way toward remedying this situation. A reorganization of the Patent Office to do more effective work in its examination of applications is desirable and possible. Whatever the defects of our present patent system may be, however, there is no doubt that it has to a notable extent stimulated invention and encouraged and rewarded inventors, and to a degree far greater than in other countries.

With regard to the proposition that patent protection exists primarily, not for the benefit of the inventor, but for the benefit of the community, Mr. Fish pointed out that the owner of the patent is rewarded by a monopoly of seventeen years in return for the gift of the invention to the public at the expiration of that time, thereby establishing a mutual obligation beneficial to all. Without such a legal monopoly inventions would be kept secret and in many cases finally lost, to the hindrance of progress.

Furthermore, every invention is potentially the cause of other inventions, and not infrequently the publishing of a patent specification leads to important improvements in radically different directions, which again serves to promote the useful arts.

Mr. Fish strongly deprecated discrimination against foreigners in the issuing of patents, as such a policy tended to check development along lines in which important pioneer work was being done in other countries.

Many patents failed because they were not needed, or because the time was not ripe for them, or again because they were not capitalized or properly exploited. Instances were given of successful patents and of enterprises that were made possible and profitable only by the stimulus given to invention by the patent laws.

The author discussed the rewards of inventors. Not only were inventors directly rewarded for their patents, but many of them were able to command much higher salaries because of their inventive capacities.

In conclusion Mr. Fish said that although in special cases our patent laws may work occasional hardships, they are among the most effective agents for the promotion of our national and individual prosperity, and as such are entitled to the cordial support of all. They were particularly entitled to recognition as a social and industrial force of the utmost importance by his hearers, many of whom are inventors of a high order and all of whom are definitely engaged in lines of work which probably could not have been developed to their present state of relative perfection in a thousand years from the date of Faraday's work and the construction of the Gramme machine if it had not been for the stimulus of the patent systems of the world, and in particular of the patent system of this country.

A prolonged discussion followed the presentation of Mr. Fish's paper.

Prof. F. B. Crocker, of Columbia Uni-

versity, sent in a communication in which he suggested the appointment of a committee to investigate and report on Patent Office reform, to be composed of representatives of the patent bar, manufacturers and operating companies, engineers who were patent experts and engineers who were not. This committee could also consider and report on the establishment of a single Appellate Court for patent cases, as well as other urgent matters in this connection. Professor Crocker also urged that the entire revenue of the Patent Office and the past accumulation be expended to benefit that branch of the public service.

A. G. Davis, of the patent department of the General Electric Company, sent in a communication in which he pointed out that the present patent system is the result of a selective development for a century and a quarter and that improvement would develop in the future as it had in the past. Reforms of the system would only be made by this slow and natural growth and not by any sweeping and radical changes.

Professor Isaac read a communication sent in by Arthur von Briesen, which consisted of a memorial circulated by the Merchants' Association of the city of New York. In this was discussed the recent patent law passed in Great Britain, as well as similar laws of other countries. The retaliatory measure in section 41 of the Payne Tariff Act, which proposed to subject foreign inventors, when they seek patents in this country, to the same rules and restrictions prevailing in their own countries, was not practical insomuch as it was a violation of existing international treaties. The memorial suggested a new international conference to bring about a complete understanding between the nations, and the entire elimination of all needless and harmful restrictions, and also to impress on other nations the advantages of the American system as compared with their own.

Dr. C. P. Steinmetz entertained the meeting with a very long discourse covering the subject from the inventor's standpoint. He emphasized especially the fact that any provision requiring the working of an invention would be fatal to the inventor. With regard to the taking out of a patent he said that it is to the inventor's advantage to have the patent lawyers take out every patent sufficiently broad to cover all modifications of the fundamental idea which may be made and to have them sustained in every instance by the courts.

Several other gentlemen spoke on the subject and all united in their appreciation of the excellence, thoroughness and timeliness of Mr. Fish's paper.

Mr. Fish, in closing the discussion, heartily endorsed Professor Crocker's remarks on the necessity for a more liberal policy as to money appropriations for the Patent Office, and concurred also with Doctor Steinmetz's thoughtful suggestions for protecting the inventor.

New York Public Service Commission.

The New York State Public Service Commission of the First District approaches the end of its second year. Meanwhile the problem of transportation within Greater New York has grown until the roads of the city carry probably 50,000,000 more fare passengers a year now than the year before. During 1907 the roads handled 66,000,000 more fare passengers than in 1906.

Commissioner Maltbie says: "One of the results now being elaborated is the more definite relations of the public to corporations as embodied in franchises. The old idea was to bargain with the corporation as sharply as possible, getting the largest amount in a lump sum for the franchise, or as large a proportion of a given annual corporate income. But the better the bargain, the heavier will be the burden upon people who use transportation. Decided progress has been made in the whole franchise question when it is put upon a basis which will express itself in better service and lower cost per unit, rather than giving a privilege to a corporation on such terms as will necessarily increase the expense of doing business and therefore tend to raise the rates or reduce the public benefits.

"As a result of the commission's work there is both greater safety and greater efficiency. In Brooklyn, there is a great deal less fatality."

The Public Service Commission has spent much of its effort in considering increase in service. It has required companies to run as many cars as physically possible during rush hours. Last year about 3,000 complaints relating to transportation service were received and about 9,000 relating to lighting corporations. Most have been disposed of informally.

Authorization of corporate securities has been conditioned upon existence of sufficient property as a basis and upon requirement that expenditure of the proceeds be applied for the purpose prescribed. This has exempted corporations from the various inroads upon revenues which formerly did so much to ruin public service corporations.

Travis-Robinson Subway Bill Signed by Governor Hughes.

Governor Hughes of New York on May 26 signed the Travis-Robinson bill designed to permit the building of additional subways in New York city by private capital, public funds or by assessments on the property benefited. The measure authorizes the city to take over any new subways built by private interests.

Immediately upon receipt of a message from Albany that the Governor had affixed his signature to the Travis-Robinson bill, designed to amend the Rapid-Transit law so as to permit of the construction of rapid-transit lines by private capital, the New York Public Service Commission sent letters to the various corporations that have recently submitted various propositions to the board for its consideration. These companies were the Interborough Rapid Transit Company, Brooklyn Union Elevated Railroad Company, the Amsterdam Corporation, Bradley-Gaffney-Steers Company and the Continuous Transit Company.

Electric Headlights.

An interesting situation has arisen in the state of North Carolina over the recent enactment of the Legislature requiring that all locomotives be equipped with electric headlights of at least 1,500 candlepower. The Atlantic Coast Line has asked for total exemption and the Seaboard Air Line for exemption for day trains and branch lines, while the engineers are making a strenuous effort to have the law carried out to the letter. The corporation commission has had several hearings over the matter, but nothing definite has been decided upon as yet.

Adopts Tesla's Device.

The Alabama Consolidated Coal and Iron Company has adopted Nicola Tesla's new device for increasing power while minimizing the size of the power-producing plant. Mr. Tesla says that he will not be in a position to make known the details and exhibit the principle in operation for perhaps six weeks. He also states that the apparatus to be built for the Alabama concern will not be one-third of the size of the ordinary air-blast machinery equipment for such work, and the air blast and other effective results will be far superior in volume and value to those at present generally used.

Production of Copper in 1908.

A statement showing the production of copper in 1908, prepared by B. S. Butler, has just been given out by the United States Geological Survey.

The production of smelter copper in the United States in 1908 was 942,570,721 pounds. This is the largest production ever made, exceeding that of 1906 by 24,765,039 pounds and that of 1907 by 73,574,230 pounds, or 8.4 per cent.

In the following table the production for 1908 is given for the principal states in which copper was mined. The total is made up of the fine copper content of blister produced and of the smelter output of ingot and anode copper from Michigan. The production of 1907 is given for comparison:

PRODUCTION OF COPPER IN THE UNITED STATES IN 1907 AND 1908.

(Smelter output, in pounds fine.)

	1907.	1908.
Alaska	7,034,763	4,438,836
Arizona	256,778,437	289,523,267
California	33,696,602	39,643,835
Colorado	13,998,496	13,943,878
Idaho	9,707,299	7,256,086
Michigan	219,131,503	222,289,584
Montana	224,263,789	252,503,651
Nevada	1,998,164	12,241,372
New Mexico	10,140,140	4,991,351
Tennessee	19,475,119	19,710,103
Utah	66,418,370	71,370,370
Wyoming	3,026,004	2,416,197

The production of refined new copper of domestic origin in 1908 was 875,849,129 pounds, an increase of 91,577,702 pounds, or 11.6 per cent, over the production of 1907. The total output of refined copper (exclusive of domestic scrap, etc.) by domestic refineries in 1908 was 1,094,700,123 pounds. The details of production for 1907 and 1908 are shown in the following table:

PRODUCTION OF REFINED COPPER IN 1907 AND 1908.

(In pounds.)

	1907	
	Domestic Origin.	Foreign Origin.
Electrolytic	592,326,608	245,062,814
Lake	178,534,141	.....
Casting	13,410,678	3,182,006
Total	784,271,427	248,244,820
Total output, domestic refineries	1,032,516,247	

	1908	
	Domestic Origin.	Foreign Origin.
Electrolytic	656,179,349	218,716,268
Lake	195,503,099	.....
Casting	24,166,681	134,726
Total	875,849,129	218,850,994
Total output, domestic refineries	1,094,700,123	

The 1908 figures for domestic electrolytic include 26,786,485 pounds Lake copper which were refined electrolytically; those for 1907 contain 34,917,988 pounds Lake copper.

In addition to this production of refined copper, 9,705,103 pounds (of which 2,551,077 pounds were electrolytic and 7,154,026 pounds were castings) were recovered during the year by the regular copper-refining companies of the country from domestic scrap, drosses, etc., and returns from practically all the known refiners of secondary material indicate that 13,508,574 pounds were turned out by them as casting copper and in alloys.

The production from secondary sources in 1908 was about 23,000,000 pounds, as compared with about 60,000,000 pounds for 1907.

Returns from all smelting and refining companies show that the following stocks of electrolytic, Lake, and casting copper were on hand at the beginning and end of the year:

STOCK OF REFINED COPPER.

January 1, 1908	125,745,796
January 1, 1909	121,876,759
Stocks decreased during 1908	3,869,037

Undelivered sales are excluded from these figures. Stocks carried by consumers and brokers have not been ascertained. In addition to the stocks of refined copper there were at smelters, in transit to the refineries, and at the refineries blister copper and material in process of refining to the amount of 175,254,659 pounds January 1, 1908, and 234,013,843 pounds January 1, 1909.

The apparent consumption of refined new copper in the United States in 1908 was about 480,000,000 pounds. The method of deriving this figure is shown in the accompanying table. In addition to the new copper consumed, probably nearly all of the 23,000,000 pounds derived from secondary sources entered into the year's consumption.

CONSUMPTION OF REFINED COPPER IN 1907 AND 1908.

(In pounds.)

	1907.	1908.
Total refinery output	1,032,516,247	1,094,700,123
Stock at beginning of year	46,497,181	125,745,796
Total available supply	1,079,013,428	1,220,445,919
Refined copper exported	465,496,007	*618,613,842
Stock at end of year	125,745,796	121,876,759
Total withdrawn from supply	591,241,803	740,490,601
Apparent consumption	487,771,625	479,955,318

*Exports of pigs, bars, ingots, plates, etc., reported by the Bureau of Statistics, less 43,262,285 pounds of blister exported without refining.

Want Fulton Street Cars Again.

The holders of sixty-seven bonds of the Fulton Street Railroad, the half-mile horse-car line of the old Metropolitan system through Fulton Street, New York city, that was capitalized at upward of $4,000,000 a mile, have applied to the Public Service Commission to reopen hearings that were concluded last winter, on the subject of ordering the receiver of the Fulton Street road to continue its operation. The receiver is Gilbert Montague, who testified that when he took possession a year ago he found as the only assets a line of rusty rails and some turnouts.

Dartmouth's New Head.

Prof. Ernest Fox Nichols, former head of the department of physics at Dartmouth College and now Professor of Experimental Physics at Columbia University, has been elected President of Dartmouth, to succeed Dr. William Tucker, who resigned on May 12, 1907, on account of ill health.

Professor Nichols is forty years of age. He is a native of Leavenworth, Kan. He attended the Kansas Agricultural College, afterward taking a post-graduate course at Cornell, being graduated with the degree of Master of Science. After five years abroad at the universities of Cambridge and Berlin, he returned to this country and became a Fellow of Physics at Cornell.

Upon finishing this course Dr. Nichols was appointed Professor of Physics and Astronomy at Colgate University. He occupied this chair until 1898, when he was called to Dartmouth to become Professor of Physics. He was called to the chair of experimental physics at Columbia College in 1903.

Wireless Weather Reports.

Willis L. Moore, head of the Weather Bureau, has sailed from New York for London, where a committee of experts is to hold a meeting. At that meeting Professor Moore will urge the adoption of a plan to compel every licensed vessel to carry a wireless-telegraph outfit and operator and to transmit reports of the weather conditions. In this way every vessel will know where storms are, at what rate of speed they are traveling and where they are going.

In addition to the wireless telegraph plan, Chief Moore wants a uniform storm signal adopted, so that any man, irrespective of the language he speaks, can recognize what the signal means when seen flying from lighthouses or ships. If the wireless plan is adopted every vessel and steamer on the water will have to take a weather observation at a certain hour and transmit. It will also have to transmit other observations transmitted to it.

At the London meeting there will be one representative from Great Britain and one from France, one from Russia and one from Germany.

An Awakening.

Dispatches from Tombstone, Ariz., state that C. L. Cummings of that city has asked for an electric-light and power franchise there.

Chicago Elevated Merger Off.

The elevated merger negotiations have been declared off. A hitch over the South Side Elevated terms was the cause. The company demanded an ultimate guarantee of eight per cent instead of six.

President Insull, of the Commonwealth Edison Company, says: "The elevated situation stands exactly where it did before the merger negotiations began."

The Cobe-Boisot-Insull committee, in charge of the elevated lease negotiations, issued the following: "For some time progress has been so made with the Northwestern and Oak Park lines as to justify us in the belief that no practical difficulty would arise in concluding arrangements with them. In negotiations with the Metropolitan substantial progress has been made, but not to an extent sufficient to justify us in stating whether or not agreement would have been reached. Negotiation with the South Side line has terminated. We have not been able to meet the requirements of the directors of that company as to the amount of rentals. Inasmuch as we do not think it advisable to effect unification of the elevated lines except upon the basis of operating all the properties, we do not think it advisable to proceed further with the negotiations.

The New York Edison Company's Exhibit at the Conference on City Planning and Municipal Art.

The work of civic beneficence which is being carried on by the lighting corporations in the city of New York is manifested by the street-lighting fixtures in use. A number of the different types were exhibited for two weeks at the Twenty-Second Regiment Armory, New York city, as noted in our issue of May 15, and among them were those which are illustrated herewith.

When arc lamps were first installed in New York city in 1880 by the Brush Electric Illuminating Company the posts were of cast-iron, but later a design was adopted by the Board of Electrical Control which called for an iron base with hollow wooden shaft, as shown in Fig. 1. In this particular post the connection was made through a wrought-iron pipe run alongside of the post.

Upon the introduction of the enclosed type of arc lamp the hood no longer became necessary, and the type known as the Bishop's Crook, shown in Fig. 2, was adopted, and these are in general use throughout the city. The outer globes used in connection with this type of post are in nearly all cases of clear glass, with inner globe of opalescent glass. They are direct-current, 6.6-ampere, 450-watt lamps.

This type of post is not satisfactory where trees line the streets, and a number of mast-arms were tried; the most successful is shown in Fig. 3, which was first installed upon Seventh Avenue in 1908. With this post the lamp is about twenty feet above the pavement and twelve feet out from the curb.

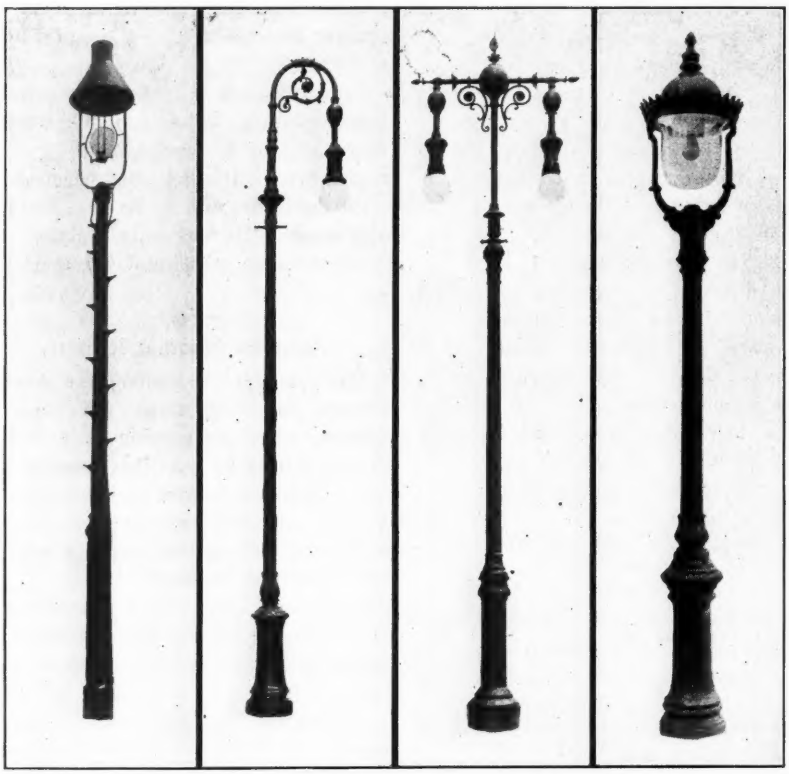


Fig. 1.—Early New York Arc-Lamp Post.

Fig. 2.—Bishop's Crook Post.

Fig. 5.—Twin Lamp-post.

Fig. 6.—Post for Tungsten Lamp.

ELECTRIC LAMP POSTS USED IN NEW YORK CITY.

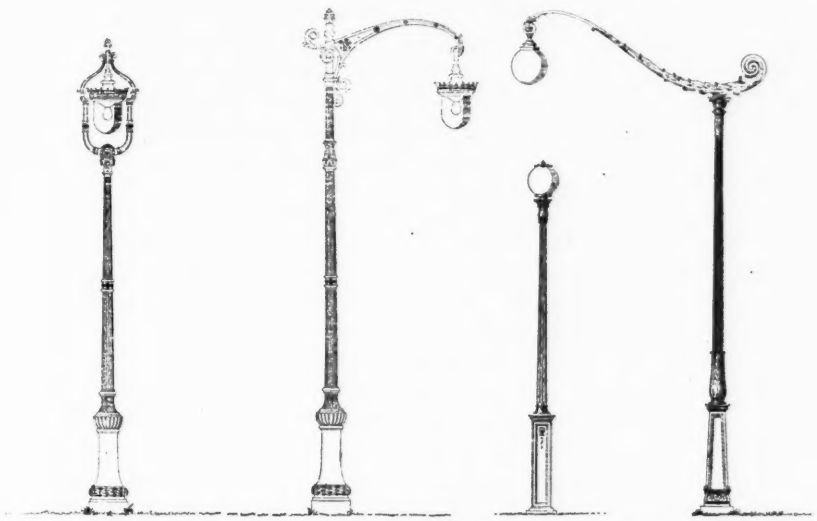
FIG. 3.—MAST-ARM POSTS USED IN NEW YORK CITY.

The type shown in Fig. 4, known as the "lyre top," is used upon boulevards in the center plots, in connection with the mast-arm type, which is installed at the curb. With installations of this character the glassware consists of clear inner and light alabaster outer globes.

FIG. 4.—"LYRE-TOP" POST ON NEW YORK BOULEVARDS.

The first installation of ornamental posts was made upon Fifth Avenue in 1892, when twin lamps were installed. The posts are the same as shown in Fig. 5, but the enclosed lamps were adopted a number of years later; these lamps consume 250 watts each, or 500 to the post.

Tungsten lamps were first used for park lighting in 1908, the posts in this case being the property of the city, having been previously used for gas. The company furnished the lanterns, lamps, and laid all underground wires, etc. This type, shown in Fig. 6, brings the lamp about ten feet above the street, which is not high enough, so the company has had four models of proposed types made of plaster, and these are shown in Figs. 7, 8, 9 and 10.



Figs. 7 and 8.—Posts for General Street Lighting.

Figs. 9 and 10.—Posts for Park and Boulevard Lighting.

PROPOSED DESIGNS FOR TUNGSTEN LAMP-POSTS IN NEW YORK CITY.

Copyright by New York Edison Company.

The problem of artistic as well as adequate lighting of a modern city is one which requires not only a generous outlay of money, but also painstaking care. J. W. Lieb, Jr., associate general manager of the New York Edison Company, and C. F. Lacomb, chief engineer of light and power for the city of New York, have given the matter great attention, and that their efforts have been crowned with success is well established, not only by the exhibit, but by the lighting conditions as they exist.

Broadway-Lexington Subway.

The New York city Board of Estimate and Apportionment has approved the change of plan of the Broadway-Lexington subway providing for the double-decking of the route in Lexington Avenue from Houston Street to the Harlem River.

Mexican Electrical Developments.

The Mexican Light and Power Company recently took over from the contractors the entire construction work going on at and near Necaxa, in order to push the work to completion in the shortest possible time. The contractors only lacked about 100 metres of completing the tunnel which will divert the waters of the river about six miles east of Necaxa into the Tenango reservoir, whence it will be brought through a 1,300-metre tunnel into another big reservoir. The dam for the big main reservoir at Necaxa is now practically completed, and the finishing touches will be done by July 1. The reservoir will hold 45,000,000 cubic metres of water.

The Mexican Northern Electric Power Company has practically completed negotiations for the purchase of the concession for the establishment of a great hydroelectric plant and system of transmission lines in the state of Chihuahua. This company is composed of Canadians who are largely interested in the big electric power and transmission system at Nacaxa and this city. The company already owns a concession for the installation of a large hydroelectric plant at La Jara, state of Chihuahua. The concession which it has just secured was owned by Governor Enrique C. Creel of Chihuahua, Paul Ginther of Santa Rosalia, and others. It authorizes the installation of a hydroelectric plant on the Conchos River about seventeen miles above Santa Rosalia, state of Chihuahua. A great dam will be built across the river, by means of which about 24,000 horsepower will be developed. It is planned to build transmission lines from the proposed station to the city of Chihuahua and the mining districts of Parral, Santa Eulalia, Almolaya, Naica and others. The concession also embraces the right to irrigate 150,000 acres of rich Conchos River valley land from the water of this storage reservoir. It is claimed that approximately 1,840,000,000 metres of water can be impounded in the reservoir.

The first shipment of 100 iron towers for building the electric transmission line from Guadalajara to the mining districts of Etzatlan and Hostotipaquillo, state of Jalisco, have arrived from the United States, and their erection will soon be started. It is stated that 1,000 of these towers in all will be required. The power will be obtained in the beginning from the Las Juntas plant of the Compania de Tranvias, Luz y Fuerza of Guadalajara, but the contract has been let for the installation of a new hydroelectric plant on the Santiago River near Guadalajara, from which the power will be obtained later. This new plant will have a capacity of 12,000 horsepower. It is planned to have the towers erected and the wires strung so that power can be furnished the two mining districts by October 1 of the present year.

An American syndicate, headed by Epes Randolph, of Tucson, Ariz., head of the Cananea, Yaqui River & Pacific Railroad in Mexico, is arranging to build an electric railway system sixteen miles long that will unite the city of Guaymas with the suburban towns of Aurora, San Jose, de Guaymas and Empalme.

The electric railway which the Canadian syndicate, headed by Dr. F. S. Pearson, will build between Mexico City and Puebla, will be one of the greatest scenic routes in Mexico. A. V. Nesbitt, the locating engineer, has selected a route for the proposed line that runs between the two volcanoes, Popocatepetl and Ixtaccihuatl. For a portion of the distance the road will run above the winter snow line of these mountains. The line will be about ninety miles long. The power for operating this line will be obtained from the hydroelectric plant of the Mexican Light and Power Company at Nacaxa.

Wireless Telephone Trials.

Trials of the wireless telephone system invented by Naval Lieutenants Jeance and Colin were made on June 5 at Toulon, France, between the armored cruiser Conde, which was at sea, and stations on shore.

The Rehabilitation of the Chicago Street Railways.

At a joint meeting of the Electrical Section of the Western Society of Engineers and of the Chicago Section of the American Institue of Electrical Engineers, held on the evening of May 28 in the rooms of the former society, Monadnock Block, Chicago, the subject for discussion was the rehabilitation of the street-railway systems of Chicago. Three principal addresses were made by members of the Board of Supervising Engineers, Chicago Traction.

Bion J. Arnold, chairman and chief engineer of this board, made the first address. He gave a general résumé of the preliminary agitation of the traction question that had preceded the final adoption of the new ordinances in February, 1907. The new ordinances were the result of many years of work by engineers employed by the city. A traction-valuation commission was appointed in 1906, which made a careful appraisal of the surface traction properties and placed their total value at $47,000,000 without considering the value of pavement, and at $52,000,000 if the paving work done by the companies were to be compensated. As a final compromise the committee on local transportation of the City Council agreed on a combined value of $50,000,000. In reviewing the main features of the new ordinances, Mr. Arnold pointed out that the city now knows the exact value of both these properties, since subsequent to the appraisal referred to an exact record has been kept of all additions to the capital account and these are certified to by the board every month. The Board of Supervising Engineers was organized as the result of one of the provisions of these new franchises. Under its control there has been expended some $30,000,000 up to the present time in the rehabilitation of the properties in accordance with the ordinance requirements. The theory of the ordinances is that the city may purchase the properties at six months' notice for the original valuation determined by the appraisal referred to, plus the added capital investment that has been incurred in the rehabilitation work. Besides putting the entire equipment into the most perfect condition that modern engineering practice calls for, the companies are expected to maintain this high standard of equipment up to at least eighty-five per cent of its original perfect condition. After deducting all operating expenses and fixed charges, the net proceeds are divided almost equally between the companies and the city. The Board of Supervising Engineers is authorized not only to make careful examination of the engineering work done, but is compelled to keep a perfect record of all expenditures made under the ordinances. For this purpose an elaborate system of auditing has been established; examination is made of the companies' books, and the reports of the field engineers in charge of the work are consulted for verification of all accounts.

Harvey B. Fleming, chief engineer of the Chicago City Railway Company, then read a paper entitled "Street-Railway Car-House Design and Operation," in which he treated exhaustively the recent practice of his company on this subject. On account of the very heavy losses by fire that had resulted in the destruction of many car-houses and their contents within the past years, the board determined that all new car-houses should be fireproof throughout and that they be divided into sections or bays. Those that are to be remodeled at considerable cost so as to accommodate the large new cars are also to be fireproof. Those that are to be temporarily remodeled until new car-houses can be built are to be reconstructed at the least possible expense, and to be abandoned as soon as the new structures are completed. To facilitate operation, it was also decided to make the car-houses of the double-end type as far as possible. Mr. Fleming described the provisions that are made in each structure for the benefit of employes, such as gymnasia, libraries, locker and lunch rooms. The standard size of bays adopted was 490 by thirty-eight feet, giving room for thirty double-truck cars on three tracks. The middle part of each track is provided with a pit for the examination of the motors and trucks. The advantages of the double-end plan were clearly pointed out. Each bay contains an overhead crane, which enables a car body to be removed from one to another truck in three minutes. There is a good equipment of tools for general repairs. The complete overhauling of the rolling stock is done only at the car shops of the company. The power supply for each car-house and for the trolley sections immediately surrounding it is controlled from a switch room accessible from the street, so that the power may be cut off from any section in case of fire or other emergency. In appendices to his paper Mr. Fleming described in detail a number of features relating to the operating methods used at the car-houses. Among these was a discussion of the elaborate system of keeping track of the exact condition of every car. This is done by the motormen, who must report on the matter every time a car is turned in. A very simple and yet complete method of keeping record of exactly what amount and the character of the cleaning done on each car each day is also kept. There are also kept on file complete reports on cars found defective in service or that have to be pulled in for any cause.

George Weston, the city's representative on the board, gave a general summary of the engineering requirements of the ordinances and how these are being carried out. Among these features was the provision of 800 double-truck "pay-as-you-enter" cars for the South Side system, and 1,200 such cars for the North and West Side systems. The Chicago City Railway Company has practically completed its work on this part of the equipment. The Chicago Railways Company has already in service about three-fourths of an order of 600 of these new cars. There were also ordered fifty cars of this pattern to be built almost entirely of steel. The idea of providing steel cars was in line with the probable building of subways in the downtown district. This company will order some 400 more double-truck cars this year. The underground work required by the companies consisted of about 6,500,000 duct-feet for the installation of feeder cables. It was decided to make fifty volts the maximum drop in the feeders except on very remote lines, and to make twenty-five volts the maximum drop on all the negative return. The organization of the engineering staff of the board was outlined; it now consists of about 137 men. The work has been distributed among a number of divisions to look after its various phases. A total of 213 miles of single track had to be rehabilitated on both systems within the reconstructive period of three years. Of its share of this work about ninety per cent has been finished by the Chicago City Railway and about sixty-eight per cent by the Chicago Railways Company. There have been installed 132 pieces of special work, such as crossings, curves, etc., and seventy-nine cross-overs. Four new car-houses have been practically finished on the South Side system, and four are being erected on the Chicago Railways system. The equipment of substations by both these

ecmpanies so as to receive current at 9,000 volts from the Commonwealth Edison Company's system was briefly described. This installation has enabled these companies to provide for their added power needs without additional or reconstructed power houses. Much study has been made recently on the subject of adequate ventilation of the cars, and a number of methods are being tried out. The old La Salle Street and Washington Street tunnels under the Chicago River, which were abandoned for some time, have been ordered rebuilt at once at lower levels, so as to provide for a deeper river, and also so as to connect with any future subway construction in the downtown district. Temporary approaches to the street grade will be built.

The discussion was opened by B. I. Arnold, who sought information from the members of the board on the provisions being made for new loops and the re-routing of cars in the downtown district of Chicago to relieve the great congestion now existing. Mr. Arnold stated that there was up to the present time little opportunity to carry out any comprehensive system of re-routing on account of the physical difficulties that had not as yet been eliminated. However, this year considerable advance in this direction will be made. A large amount of reconstruction has been ordered on the downtown streets, and an increasing number of through routes will be put in operation. By means of these and by the building of loops, it is hoped to increase the facilities for traffic and to decrease the congestion to a marked degree. However, it must be remembered that the growing needs of the city will require that in the future use must be made, not only of subways beneath the streets, but of the street surface and the space above it.

P. Junkersfeld described briefly the provisions made by the Commonwealth Edison Company to take care of the railway load. In general, its equipment in its two principal power stations and in its transmission system is of the highest standard, and fully in accord with the general practice that has been adopted on the rehabilitated lines.

Others who discussed the subject briefly were E. N. Lake, D. W. Roper and Chairman W. B. Jackson. In closing the discussion Mr. Arnold spoke of the disposition that should be made of the promotion charges. This was a matter of current interest and has not been entirely solved.

Subterranean Long-Distance Telephones.

With the extension of the long-distance-telephone system last summer as far west as Denver, it is now possible to talk from Chicago to the bottom of some of the deepest mines in the Rockies.

Up at Idaho Springs, the center of the famous Clear Creek district, where the Newhouse tunnel has been run under the mountains for over three miles to connect a network of underground workings, there is a mine now down 2,500 feet. This mine, like many others, has its own telephone system, which is connected with the surface telephones. At the bottom of the deepest shaft, 2,500 feet under the mountain, there is now a telephone instrument, and standing there in the bowels of the earth one can call up Chicago.

Of course, telephoning in a mine isn't quite as easy as it is in a sound-proof telephone booth, especially if the great drills are working. Nevertheless, the miners get used to the racket and seem to have no trouble talking over the telephone, though to others it is almost impossible at the first few attempts.

They tried talking to Chicago last summer, when the arrival of the long-distance telephone caused almost as big a sensation in Colorado as did the first railroad. It is a common occurrence to talk with Denver, forty miles away, from some of the subterraneaan workings in the Rocky Mountains.

The telephone instruments in the mines are specially constructed with a view of protecting their delicate parts from the dampness. At Idaho Springs there is a regular telephone system under one of the mountains where there are over a hundred mines, all of them tapped by an underground railway through which the telephone wires run.

Electrification in Utah.

Dispatches from Salt Lake City, Utah, state that the Bingham Construction Company, the corporation organized by F. A. Heinze to operate the Mascotte tunnel enterprise in the camp of Bingham, has just placed an order for 160,000 pounds of steel ore cars that will be used in the transportation of ores from the Ohio Copper Company's mines to the big milling plant near the mouth of the Mascotte tunnel.

This equipment will be the finest of its kind ever placed in a tunnel in Utah, and it is understood that the electric locomotives which are to handle the trains through the Mascotte tunnel will also be the finest that money can buy.

Destruction of Telephone Poles by Insects.

Insects play a most important part in timber destruction. The injury done is generally underestimated, as their depredations go on gradually, but forcibly, attracting little observation. When they bore into the timber they open up air chambers and channels, which make it easy for rainwater to seep in, and thus keep the wood in a moist condition. Fungus spores floating through the air are enabled to germinate with greater rapidity and with increased effectiveness, and the decomposition of the pole consequently is materially hastened.

Several years ago the United States Forest Service co-operated with one of the large telephone companies in Georgia and Florida to experiment with various preservatives in protecting the butts of telephone poles from decay. These preservatives were simply painted upon the wood, and, of course, did not sink in to any great depth. A recent examination made of this pole line showed that wherever the preservative had entered the wood no destruction due to insect attack had taken place, but where the wood was unprotected, such injury was frequently quite serious. Poles in which the preservatives had seeped through a crack were often more or less fluted on the surface, that is, the oil saturating the wood in the immediate vicinity of the crack protected it from the attacks of the insects. It is essential, therefore, particularly in the warmer portions of the United States, to protect timber from the attacks of insects as well as of fungi, if the longest life is to be secured.

New England Section, Illuminating Engineering Society.

The June meeting of the New England Section of the Illuminating Engineering Society was held in Boston the evening of June 15, when a paper on "The Efficiency of the Small Mantle Burner" was read by Norman Macbeth, manager of the Welsbach company's illuminating engineering laboratories. Mr. Macbeth illustrated his entertaining and instructive lecture with stereopticon views. Previous to the meeting an informal dinner was held at Louis' restaurant. These dinners for "city bound" members have become a popular feature of the monthly programme.

Electric Booth at the Scranton Industrial Exposition.

That electricity is just as essentially a manufactured product as horseshoes, roofing or typewriters, is further evidenced by the conspicuous part the Scranton Electric Company took in the first industrial exposition held in that city but a few weeks ago.

The electric booth, designed by L. H. Conklin, general manager, and Duncan T. Campbell, manager, of the new-business department of the Scranton Electric Company, was one of the largest and most attractive of the exhibit. It had a place right in the center of the big building, where all the industrial products of Scranton were displayed, and its

ELECTRIC BOOTH AT THE SCRANTON INDUSTRIAL EXPOSITION.

600 lights and artistically arranged decorations, not to mention the handsome electrical devices, drew one to it like a magnet. It is estimated that 20,000 people visited the booth. Five thousand souvenir fans and 8,000 pieces of literature were given away.

"Live the Electric Life," "Watch Scranton Grow," and other electric signs added to the attractiveness of the demonstration. A petite young lady was in charge of the booth to demonstrate to the numerous visitors the many possibilities for electric heat, light and power in the home. The electric range was kept busy during the whole time that the exposition was open, supplying good things to eat, and the visitors evidenced great interest in all the electrical applications shown.

THE TREATING OF TUNGSTEN IN COLORADO.

BY GEN. FRANK HALL.

The brilliant minds of the Colorado Scientific Society have for some time been devoted to the earnest study of tungsten and the various methods that have been employed in the concentration of that valuable product. Since Senator Hughes made strenuous efforts to have the duty on tungsten retained in the tariff bill a new interest in this industry has been awakened on many sides. Not very long ago Franklin Guiterman, manager of the American Smelting and Refining Company, working in behalf of a larger production and better methods of preparing tungsten ores for the market, applied to his company for a fund to enable him to make thorough experiments in that line of work, and was allowed $10,000. As generally understood, the experiments are to be conducted at the Globe smelter near this city. Tungsten may be classed among the rare minerals of Colorado, for there is only one place where it is found in large quantities. One district of Boulder County is, under favorable markets, capable of producing an amount nearly equal to the demand by steel manufacturers of this country. The chief difficulty has been the lack of suitable mills for concentrating the crude ores. Henry H. Wood states that successful wet concentration of the common forms of the ores of tungsten is a difficult undertaking, despite the fact that mills frequently claim to save seventy or eighty per cent and some over ninety per cent. In his experience, which has been large, he recalls but one recovery exceeding eighty-five per cent, and that was on Arizona hubernite in a clean quartz gangue, crushed coarse, jigged, filings reground and after tabling the over sizes, rerunning all the tailings.

All sorts of methods have been applied, all sorts of experiments used, but thus far, owing to the peculiar characteristics of wolfram ores, not one has been entirely satisfactory. Victor G. Hills, a noted scientist, who resides in Cripple Creek, says: "If I were designing a mill I should experiment with wet screen sizing. The Richards classifier might do wonders in the preparation of the pulp for the several tables. I should certainly experiment with these things in a practical way before planning or rearranging any mill for the concentration of tungsten ores." He speaks highly, however, of the Clarasdorf mill, which was designed by Eugene Stevens, a chemist, metallurgist and mill operator of recognized ability and extended experience, and erected solely for tungsten ore, and, presumably, one of the best in the district.

These brief references to expert opinions show that notwithstanding over forty years of experimenting with concentration on other Colorado minerals, and the remarkable advances made, it is necessary to go all over the route again in order to reach the proper stage of perfection in the recovery of values from tungsten ores. These things inspired Mr. Guiterman to undertake a new departure by setting up a perfectly equipped laboratory at the Globe plant and going into the research business on a broader scale than has hitherto been attempted. The sum placed at his disposal may and may not be sufficient to enable him to solve the problems involved, but that he will work out the major part of the difficulties may be accepted as among the probabilities, and if accomplished it will be of great importance to the industry of tungsten production in Colorado.

Toledo Railway Gets $10,000,000.

The directors of the Toledo Railways and Light Company, at a meeting at Toledo on May 27, authorized the execution of a contract with Blair & Company, of New York, to underwrite $10,000,000 of the railway company's bonds, which fall due July 1 next.

The London Physical Society.

The London Physical Society held a meeting on May 14 last, Dr. C. Chree presiding, at which two papers of particular interest to the electrical fraternity were read and discussed.

W. Duddell, the well-known consulting electrical engineer, read a paper on "A Bifilar Vibration Galvanometer," in which he described a new type of vibration galvanometer and a series of tests made upon it.

Vibration galvanometers may be divided into two types: (1) Those in which the moving part consists of a piece of iron or steel and the current to be measured flows around fixed coils, as in the case of the Thomson galvanometer; (2) those in which the current to be measured flows round a moving coil placed in a fixed magnetic field on the siphon-recorder principle. The vibration galvanometers of Max Wien and Rubens belong to the first class, while Campbell's vibration galvanometer and the one described in the paper belong to the second. In the instrument described the mass of the moving parts is reduced to a minimum, the moving coil being reduced to the two wires forming its two sides, similar to a bifilar oscillograph, but with this difference: Whereas the bifilar oscillograph is designed so as to make the damping aperiodic, the vibration galvanometer is designed so as to keep the damping as small as possible. A series of tests made upon the instrument showed that the total range of frequency was very large, namely, from about ninety up to 1,900 cycles per second. The damping is very small, so that the resonance is very sharp. A series of measurements on the sensibility of the instrument showed that the sensibility to alternating current decreases very nearly inversely as the frequency for which the instrument is adjusted, whereas for direct current the sensibility decreases approximately inversely as the square of the frequency for which the instrument is adjusted, which is what usually takes place with direct-current galvanometers. The sensibility of the galvanometer for detecting small alternating voltages is reduced by the back electromotive-force of the instrument, and the paper concludes with a determination of the magnitude of the back electromotive-force in the instrument shown at the meeting. The advantages of the galvanometer are its simplicity, ease in tuning, wide range of frequency for which it can be tuned, high sensibility, negligible self-induction, and comparatively small back electromotive-force.

A paper by W. P. Fuller and H. Grace entitled "The Effect of Temperature on the Hysteresis Loss in Iron in a Rotating Field" was read by Dr. E. W. Marchant, professor of electrotechnics at Liverpool University.

The rotating field was produced by means of two-phase currents. One phase was connected to a coil of long rectangular section and of sufficient length to produce a uniform field within a radius of two centimetres from the center. The second phase was connected to a similar coil enclosing this one, and causing a flux at right angles to it. The resultant field at the center was uniformly rotating. An iron disk, four centimetres diameter, 0.027 centimetre thick, was supported by a bifilar suspension and the torque measured by a mirror and scale in the usual way. The specimen was heated by means of nickel wire heaters placed above and below it, and the temperature measured by means of a thermo-junction placed close to the disk. The flux in the iron was measured by the voltage induced in a coil of eight turns of bare wire wound round it. To measure the voltage, the maximum value of which was of the order of 0.03 root-mean-square volt, a special galvanometer was constructed. This depends for its action on the forces exerted by a rotating field on a suspended coil carrying alternating currents. If E be the electromotive-force applied to the moving coil, and E_1 the electromotive-force due to the field on the coil, then, by turning the coils producing the field round until the deflection is a minimum, this deflection is proportional to $E - E_1$. The results of the experiment show that the effect of increasing the temperature of iron is to reduce the hysteresis loss at a given induction and to cause the maximum loss to occur at a lower value of the induction. In one specimen the maximum value of the loss at 220 degrees centigrade was 12,300 ergs per cubic centimetre per cycle at an induction of 16,000 centimetre-gramme-second units. At 580 degrees centigrade the maximum loss was 2,600 ergs at an induction of 10,700. The frequency of the experiments was forty-two cycles per second.

Locomotive Headlight Bill Vetoed.

Governor Hadley, of Missouri, has vetoed the bill passed by the recent session of the Legislature requiring railroads to equip all locomotives with electric headlights of 1,500 candlepower, on agreement by railroad officials to install lights of a certain power.

A. S. and I. R. A. Changes Convention Date.

The Convention Location Committee of the American Street and Interurban Railway Association has decided to change the date of the Association's convention, to be held at Denver, to the week beginning October 4 instead of from October 18 to 22, as previously announced. Members of the Association and of its various affiliated and allied associations, viz., the American Street and Interurban Railway Accountants' Association, the Engineering Association, the Railway Claim Agents' Association, the Transportation and Traffic Association and the Manufacturers' Association, are therefore being notified to this effect by Bernard V. Swenson, secretary and treasurer.

It was felt that a much larger attendance could be obtained by the change of date, and, moreover, a very decided preference was manifested toward the selection of a convention week which would enable members to take advantage of the attractive railroad rates which continue in effect until September 30, and are good for return until October 31. These rates would enable those wishing to combine pleasure with the serious business of the convention to continue on to the Seattle Exposition and to other Pacific Coast points with but a comparatively small increase in the round-trip fare. This movement finally became so pronounced that President Shaw decided that it demanded careful consideration, and immediately investigated the sentiment from various standpoints, but particularly with regard to the effect on the affiliated associations. The sentiment was unanimously in favor of the change now announced.

Production of Mica in 1908.

The total value of the mica produced in the United States in 1908, according to statistics compiled by the United States Geological Survey, amounted to $267,925. The production of sheet mica amounted to 972,964 pounds, valued at $234,021, a decrease of 87,218 pounds and $115,290 from 1907. The production of scrap mica amounted to 2,417 short tons, valued at $33,904, a decrease of 608 tons and $8,896. The value of the imports into the United States fell from $925,259 in 1907 to $266,058 in 1908, or slightly less than the domestic production.

The mica produced came from ten states, the most important of which, named in the order of the value of production, were North Carolina, South Dakota, Colorado, Alabama and Virginia.

The Seventh International Congress of Applied Chemistry.

(By Our Special Correspondent.)

In the last issue some account was given of the opening proceedings of this congress. We now proceed to give a report of some of the papers read in Section X. Section X was devoted to the subject of "Electrochemistry;" Section IIIA to the subjects of "Metallurgy and Mining." In each section a large number of papers of special interest to our readers were presented and discussed, but it is impossible within the limits of this report to give even the titles and authors of the 180 papers read in these two sections of the congress. In fact, the enormous bulk of material which has been presented in the seventeen sections and subsections at this year's meeting of the congress has led to the appointment of a special committee for editing the congress proceedings; and it has been decided that only the papers of striking originality and merit shall be printed in the official report. At the Berlin congress of 1903 it required four bulky volumes of 1,000 pages each to contain the congress proceedings; at the Rome congress of 1906 the report extended to seven volumes. The necessity for some drastic action in this matter of printing the whole of the papers read in the official report is therefore apparent, more especially as the number of contributions increases at every successive congress.

In this report we shall confine our attention to a selection of the papers read in Section X, and an attempt will be made to give useful abstracts of these, rather than a connected account of the whole of the papers and discussions.

PAPERS ON ELECTROLYTIC ALKALI PROCESSES.

On Monday, May 31, three papers upon electrolytic alkali processes were read and discussed. The first of these was by Professor Donnan of Liverpool University and Robert Finlay, and was entitled "Electrolysis of Brine with the Finlay Cell." This paper was an abstract of an earlier one which had been read before the Faraday Society in London. The construction of the Finlay cell can hardly be made clear without a diagram, but it may be described as a composite diaphragm cell, built up on the filter-press plan, the electrode chambers being made as narrow as possible. A concentration of caustic soda of between seven and eight per cent can be obtained with a current efficiency of ninety to ninety-five per cent, while the energy efficiency varies from fifty-five to sixty-six per cent, according to the rate of flow and concentration of the caustic liquor. The grammes of sodium hydrate per kilowatt-hour vary from 361 to 434, the latter figure being obtained at the lower degree of concentration; viz., four per cent of sodium hydrate. The chief merits claimed for the Finlay cell are: First, a remarkably high yield of caustic soda and chlorine; second, the small space occupied by the apparatus; third, the simplicity and cheapness of construction; fourth, the small amount of attention required in working. The Finlay cell is not yet in operation on a practical scale, so far as we are aware.

The second paper was by Dr. L. H. Baekeland, and was entitled "Three Years' Practice of the Townsend Cell." Dr. Baekeland introduced his paper by referring to one on the same subject contributed to the Society of Chemical Industry and to the American Electrochemical Society three years ago, and stated that the present paper brought the information of the earlier ones up to date. The cell has now been operated upon a commercial scale at Niagara Falls for a period of three-and-one-half years, with a plant of 1,000 kilowatts capacity, and the success attained with it has justified a large extension of the original works. This extension is now being carried out, and when completed the Townsend works at Niagara will have a capacity of 4,000 kilowatts.

There is no need to describe here the details of construction of the Townsend cell. The original cells were designed for a current strength of 2,000 amperes, but it has been found by experimental trial that the cells yield better commercial results when worked with a current of 2,500 amperes; and for the last twelve months seventy-six cells have been run at this amperage. The cells that are being erected in the new plant are larger, and are designed for a current of 5,000 amperes. It has also been found by experience that it is cheaper to run the cells at a temperature of seventy degrees centigrade, with a current density of 150 amperes per square foot, than to work the plant at the lower current density of 100 amperes per square foot originally employed, although the current and energy efficiencies are not so good when working under these conditions, and the rate of deterioration of the anodes is far greater. The cathode liquor obtained from the cell contains on the average 150 grammes NaOH and 200 grammes NaCl per litre. Working at this degree of concentration, the average current efficiency of the cell is ninety-three per cent. The diaphragms are cleaned every thirty days, while at the same time the surface blades of the anodes, which are of a composite character, are renewed as required, at a very cheap rate, using up scrap graphite for this purpose.

The evaporation of the caustic liquors is effected in the usual way by concentration in pans, worked upon the triple-effect vacuum system. The undecomposed salt is then separated out and the final concentration and production of solid caustic soda occurs in the ordinary type of finishing pot. These pots last better than was expected with liquors containing traces of hypochlorites, and in some cases over 3,000 tons of caustic soda have been produced by the one pot. The finished caustic is of good color, and contains about two per cent of carbonate and 3.6 per cent of undecomposed chloride. No cost details were given by Dr. Baekeland in his paper.

The third paper on this subject was entitled "Sodium Chloride Electrolysis Considered from the Technical Standpoint," and was presented by Herr R. Taussig, who, unfortunately, was unable to be present to read it. In the author's absence it was therefore taken as read, and the following notes upon it are based upon the official German abstract:

The paper described the different modifications now in use of the Castner-Kellner mercury cell, which the author classified as follows:

(1) The original Castner cell with oscillatory movement, as worked at Oldbury and Weston Point.

(2) The Kellner cell with a pressure vessel, as worked at Jaijce, in Hungary.

(3) The Kellner cell as modified by Solvay, and worked at Jemeppe, in Belgium.

(4) The new Castner-Kellner cell with Archimedian screw, as worked at Weston Point.

The disadvantage of the first type of cell was that the units were small, and had a capacity of only between 400 to 500 amperes. As there were 800 of these cells installed at one time at Weston Point Works, the buildings in which they were housed extended to enormous size, and the costs for electrical conductors and for the accessories of the plant were exceedingly large, and the working expenses correspondingly heavy.

The second type of cell, as installed at Jaijce, is, according to the author, the most interesting. The cell consists of three adjacent compartments, connected

the one with the other by siphon tubes. The anode or chlorine compartment is in the middle position, whereas in the original Castner cell this compartment forms the cathode chamber. The two outer chambers in the new type of cell, as worked at Jaijce, possesses depressions, into which the pressure vessels dip; and the mercury is forced from one compartment into the other by air pressure.

The mercury on passing through the center compartment takes up the metallic sodium, and gives this up again on passing through the two outer compartments. The anodes are made of platinum gauze, and the chambers in which they are placed are constructed of cement. Each anode is constructed of a series of small wings or vanes of this gauze, supported by platinum arms which are fused into a central glass tube filled with mercury. In each of the chlorine cells there are six electrode chambers, and each of these chambers is provided with eighty-eight of these platinum gauze wings. The whole cell, therefore, contains 528 pieces of platinum gauze, which weigh about 528 grammes, and serve to carry a current of 4,000 amperes. Cast-iron grids are employed as cathodes. The special feature of this cell, as modified by Kellner, is that the mercury amalgam formed in the cathode compartments, is quickly regenerated and made ready again for the absorption of more sodium. One can therefore employ a very high current density with the cell, and in this way obtain considerable economy in working costs.

The third type of cell, as modified by Solvay, is employed at Brescia, in Italy, and at Lubinof, in Russia, as well as at Jemeppe, in Belgium. The cell consists of two inclined but parallel troughs, communicating the one with the other; the mercury is kept moving by means of a screw propeller. This type of cell was originally designed to carry 6,000 amperes, but it has since been working up to 10,000, and even up to 15,000 amperes.

The new Castner-Kellner cell, as worked at Weston Point, differs from that used at Jemeppe only in the form of the screw, and is designed to work with a current of 4,000 amperes.

A very valuable paper upon "Electric Iron Smelting in France" was contributed by M. Clausel de Coussergues, of Paris, to Section X, and in the absence of the author was taken as read at the sitting of Friday morning, May 28. The following is the official abstract of this paper, the full text of which will be found in the issue of the French journal, *Le Revue de Metallurgie*, for June, 1909, which contains, in addition, a large number of the French papers contributed to the congress. M. de Coussergues' paper extends, it may be mentioned, to nearly one hundred pages and is well illustrated.

All the electric iron-smelting furnaces are, with the exception of the two induction furnaces, of the arc type. They include the Chapelet system at Allevard, Heroult furnaces at La Praz, and le Saut du Tarn, Girod furnace at Ugines, their own furnaces at Firminy, their own furnaces at Imphy, and the Kellner furnace at Unieux. The confidence shown in the practice is indicated by the fact that such furnaces are at work up to a capacity of two tons at Ugines, and three-and-one-half tons at Allevard. When possible, waterfalls supply the power—that is, at Allevard, La Praz, le Saut du Tarn and Ugines; elsewhere heat engines are used to produce the electric energy. The duty demanded from the electricity is different in the two cases; in the first instance ferruginous material is charged into the furnaces cold for the production of all qualities of steel; in the second instance the electric furnaces are reserved for refining high-class products. In fact, the controlling factor in the cost of production of electric steel is the price of the kilowatt. Hence, when this is high, as with the heat engines, it is reasonable to do the preliminary treatment by the open-hearth or other process.

Recent additions to the electric smelting furnaces in France are a five-ton Heroult furnace installed at the Saut du Tarn Works to replace crucible furnaces; at Ugines a complete electrometallurgical plant, with electric furnaces, rolling mills, forge and foundry, distinct from the old works, has been constructed—the Imphy furnaces have provided the material for M. Pourcel's investigations on the new steels; and Unieux has adopted a new form of Kellner furnace, consisting of a single cylindrical receptacle, with a spherically vaulted cover, through which pass four electrodes, two of each polarity.

THE ELECTRIC FURNACE IN OPERATION.

The electric furnace is practically only a heat producer, since the only part of it affecting the reactions chemically is the lining, which is preferably basic. Hence, provided distinctly acid slags are avoided, the whole sequence of metallurgical operations can be produced in the electric furnace. In all French works the operation of making steel is divided into two different categories, the first conducted under oxidizing conditions, while in the second reducing influences obtain. As neither any ordinary atmosphere nor blown-in air is employed during the oxidizing operations in the electric furnace, red short metal does not enter into consideration; and in almost all such works the highly calcareous slags of the basic furnaces are replaced by highly ferruginous ones. These have the advantage of melting and reacting at low temperatures, which are not only favorable to removal of phosphorus, etc., but also enable the deoxidation to be started at a desirably lower temperature. The solubility of iron oxide in the bath, it must be remembered, augments considerably with the temperature. The reducing operations follow immediately upon the removal of the oxidizing slags, and are effected by the usual agents. The products of the reaction must be either gaseous or insoluble in the bath; hence, carbon is preferred in the arc furnaces, and rich ferro-silicon in the induction furnaces. The reducing slags are not of the same character at all works, but the tendency is to have them as acid as the linings of the furnace permit. These slags are more fusible than the slags in basic-steel works, and consequently require much less fluorspar. The reduction, being the result of the interaction between the slag and the bath, if continued long enough, can effect the removal of the last traces of oxygen. When this happens the elimination of sulphur follows, inasmuch as the sulphides pass into the slags, and in the presence of lime and carbon or silicon, give rise to calcium sulphide, which is insoluble in the bath. A notable feature of steels produced in the electric furnace is their low content of hydrogen and nitrogen. The elimination of the former is specially interesting, as it arises from the reaction of the calcium carbide, formed in the electric furnace, with the hydrogen, which then forms acetylene, and passes away. The advantages of the electric furnace are summed up, and a future predicted for its extensive application.

The remaining papers can only be very briefly dealt with. The most important of these was that contributed by Dr. Bernthsen, a director of the Badische Anilin und Soda-Fabrik, upon the "Utilization of Atmospheric Nitrogen." This paper, which was illustrated by a demonstration of the new form of arc flame patented by his company, attracted an audience of over 500 to the lecture theatre of Section X on Saturday morning, May 29. Dr. Bernthsen's paper did not contain any very new information upon the subject, but the demonstration of the spiral form

of arc was a most noteworthy feature of the meeting, and was so much appreciated that a repetition of it was desired. Professor Birkeland and Doctor Caro also contributed papers to this session of Section X on the same subject.

Another paper of considerable interest was that contributed by E. R. Taylor, chairman of the Conservation Committee of the American Electrochemical Society, upon the "National and International Conservation of Water for Power Purposes." Mr. Taylor, at the close of his paper, urged that every scientific society should have its conservation committee, and he proposed that a committee of the congress should be appointed for this particular purpose. This suggestion was adopted at the closing meeting of the members of the congress, held on Wednesday, June 2.

F. A. Fitzgerald, of Niagara Falls, contributed two short papers to the Friday morning session of Section X, the one being a résumé of the papers on the "Electrometallurgy of Iron and Steel," read at the last meeting of the American Electrochemical Society, and the other being upon the "Lash Steel Process." Reports upon these subjects have already appeared in our columns. The two papers, of which short abstracts follow, were also planned for the Saturday morning session of Section X, and in the absence of their authors were taken as read.

The paper "Relative Efficiency of the Arc and Resistance Furnace for the Manufacture of Calcium Carbide," was read by Samuel A. Tucker.

Calcium carbide was prepared in the two types of furnace mentioned under conditions which would give the best yield. Comparison is made of the product as to its carbide content and its weight obtained per energy unit. The results show that for the scale on which the experiments were conducted the resistance furnace is much superior to the arc. The best results obtained with the arc furnace was 1,170 watt-hours per 100 grammes of pure carbide, while with the resistance furnace the same quantity of pure carbide was obtained with 544 watt-hours.

Information is also given as to the best proportions of lime and coke to be used with the two types of electric furnaces employed.

An interesting paper on the subject of "Calcium Carbide" was presented by C. A. Hansen.

The equilibrium CO pressure in the reaction between CaO and C was determined at 1,380 degrees, 1,530 degrees and 1,780 degrees centigrade, by sealing the reagents in an evacuated furnace, which could be kept at a constant temperature, and by measuring the CO pressure on a mercury manometer. The exterpolated pressure-temperature diagram indicates reaction at a temperature as low as 1,275 degrees centigrade.

It was shown that at a temperature of 1,450 degrees centigrade, reaction took place when the CO pressure was kept below its critical value, and that at the same temperature, in a sealed furnace, reaction ceased when the critical pressure was established.

In the paper a short list of reduction temperatures for various oxides of carbon, determined in the same furnace, is given.

J. B. C. KERSHAW.

London, June 5.

Cleveland Industrial Exposition.

The Cleveland (Ohio) Industrial Exposition, which opened June 7 and which will close on Saturday evening, June 19, has proved a great success.

The management of the show was exceptional, as all the details were completed before the opening, and this in spite of the fact that there are no less than 282 large exhibits, occupying a floor area of 115,000 square feet, and of an aggregate value of more than $2,000,000.

An idea of the massiveness of the exhibition may be obtained from the fact that more than 2,000 attendants are required in the exhibits for demonstrating purposes, that the booth railings measure nearly three miles, and that the temporary building erected as machinery hall has a larger ground-floor area than any other exposition hall in the United States.

The show, which is under the auspices of the Cleveland Chamber of Commerce, includes only home products of the city of Cleveland, which, besides possessing manufactures of an extremely diversified nature, is the foremost manufacturing city in the country in many lines, including electric carbons and electric automobiles.

Navy Department Supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on June 22 for thirty-six fan motors, for delivery at Brooklyn navy yard (Schedule 1325); on June 29, for one electric elevator and one electric traveling hoist, for delivery at Mare Island (Cal.) navy yard (Schedule 1304); on July 6, for 14,330 feet rubber-covered wire, for delivery at Mare Island, Cal. (Schedule 3).

The Chicago Electric Club.

The Chicago Electric Club held its regular meeting on Wednesday noon, June 9. The smallness of the attendance was regrettable in view of the interesting nature of the topic under discussion, "Lincoln Park, Its Ambitions, Its Progress and Its Effect upon the City," which was handled in a most entertaining way by Francis T. Simmons, president of commissioners of Lincoln Park. Mr. Simmons gave some interesting details of the progress and development of the park, the most popular one in the city, and of its complete rescue from the greedy clutches of the politicians. Two maps of the proposed extensions were distributed, and details were given of the successful efforts to fill in part of the lake to extend the park, out of the material dredged from the yacht harbor.

New York Electrical Society Elects Officers.

At the annual meeting of the New York Electrical Society, held at the Waldorf-Astoria, New York city, Tuesday evening, June 15, the following officers were elected: President, Theodore Beran; vice-presidents, John Bottomley, Frederick A. Scheffler, Charles H. Hadlock; secretary, George H. Guy; treasurer, Henry A. Sinclair.

For Lower Cable Rates.

The question of cheaper cable rates between the colonies and the mother country was debated with enthusiasm at the meeting of the Imperial Press Congress at London. T. D. Ross, of Ottawa, urged that there should be government cable lines between England and Canada and beyond Canada under the Pacific. He expressed the conviction that state-owned cables would mean that the rate on commercial messages could be reduced without loss to five cents a word.

Free Transportation and Linemen.

Advices from Washington, D. C., state that in response to an inquiry addressed to the Interstate Commerce Commission as to whether a rail carrier has the right to issue free transportation to linemen of telephone and telegraph companies not employed on its line, it has been held by the Commission that it adheres to its former decision that linemen are not entitled to free transportation except upon the line of railway on which they are actually employed, and only during the time they are so employed.

RECENT IMPROVEMENTS IN UNDERGROUND CONDUIT CONSTRUCTION.

BY S. B. WAY.

The city of St. Louis, Mo., has, during the past two or three years, witnessed some radical departures from accepted methods of conduit construction. During the year 1906 the electric-light and power interests of that city found it desirable to install considerable conduit incidental to an extension of the system of distributing electricity for general use and for extending high-tension feeders to reach distant street-railway substations. A fairly large stock of multiple-duct tile conduit was on hand, but not in sufficient quantity to supply the requirements of the work contemplated. An investigation of the conduit market developed a condition not at all encouraging to those responsible for the completion of the work in hand within the required time, in that all of the conduit manufacturers were then already sold out of the kind of duct desired.

This state of affairs made it necessary for the engineers in charge of the work to choose between completing the work with such conduit as could be purchased and delivered within the time limit or to devise some means of building a conduit without the usual tile, or other pipe.

The engineers chose to make an attempt to get along without the pipe, and incidentally save money in the cost of construction. This resulted in building a conduit entirely of concrete.

Upward of 170,000 duct-feet of all-concrete, or monolithic conduit, have been laid in St. Louis within the last three years, fulfilling every requirement for all uses, from single-duct runs with frequent junction or service boxes, to replace Edison tube, to heavy isolated runs for high-tension cable.

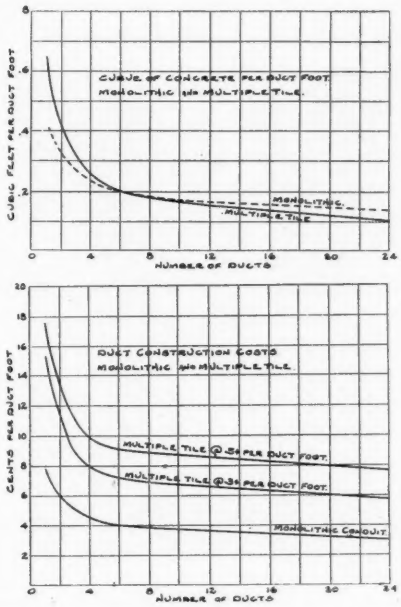


FIG. 1.—CURVE OF CONCRETE PER CUBIC FOOT AND COST PER DUCT FOOT.

The ideal conduit, or housing, for underground conductors must have smooth, clear, jointless, fireproof duct openings, free from pockets or depressions in which water may lodge; should be laid true grade to drain to manholes; must be constructed of a material of high electrical resistance, and which will be homogeneous and not deteriorate with age; must be strong and able to sustain itself and a considerable load over fairly long spans; and it must be cheap.

It has been found that all-concrete, or monolithic conduit, possesses many advantages, in that with such construction the structure becomes homogeneous; occupies little space for a given number of ducts of equal size; permits perfect inspection of each duct from end to end incidental to the laying of each tier; provides smooth, straight, clear, jointless and fireproof duct openings from manhole to manhole; eliminates handling, fitting, breakage and cost of pipe; requires no factory, and but few and simple special tools; and for average duct sections uses no more material (concrete) than is required for the armor or envelope of pipe construction. The amount of concrete per duct-foot required for various duct sections for multiple-duct tile and for monolithic conduit and the cost per duct-foot of completed work, exclusive of trenching, refilling and repaving, are shown by curves in Fig. 1. These curves were plotted from results obtained in actually laying a considerable quantity of each type of conduit under the same supervision and by the same men. The multiple-duct tile was laid with a three-inch armor of concrete and with the interstices between the tiles filled with fine concrete, while the monolithic conduit was provided with two-and-one-half inches of concrete between the ducts and the bottom and sides of the trench, with a cover or top three inches thick. The items of trenching, refilling and repaving are nearly constant for each type of conduit, except a small differential of about one-half cent per duct-foot in favor of monolithic conduit, due to the smaller trench and consequent reduced excavation and hauling of displaced earth required by the monolithic construction.

Typical cross-sections of multiple-duct

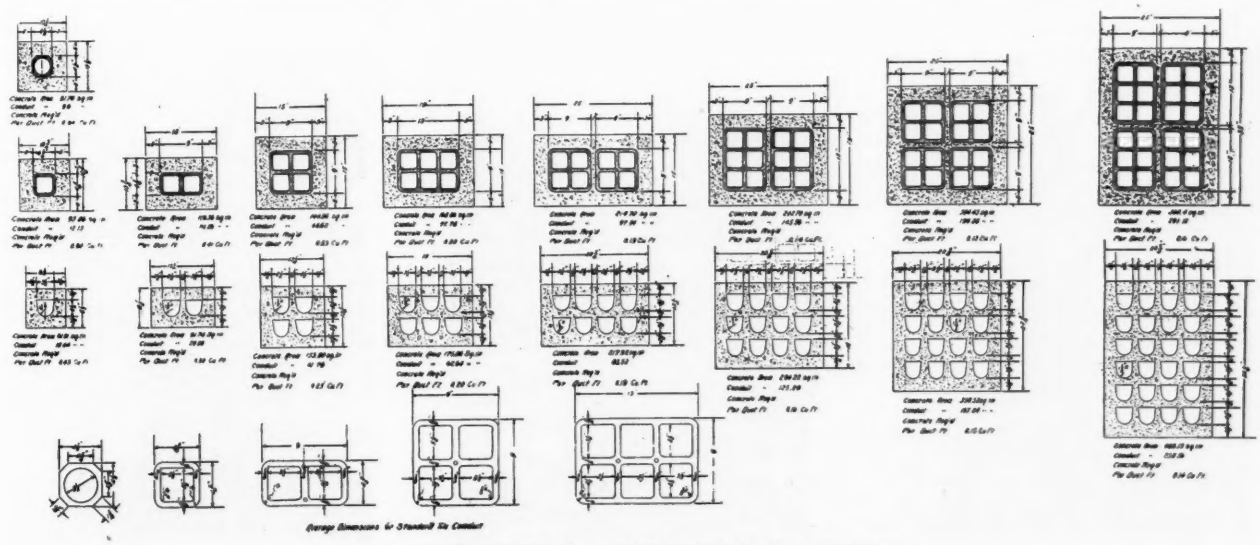


FIG. 2.—DRAWING OF CROSS-SECTION OF CONDUIT.

tile and monolithic conduits are shown in Fig. 2.

The construction of monolithic conduit involves only the comparatively simple methods of good concrete work.

After a trench of suitable width and depth has been excavated, duct-form supports are set to grade and perfect alinement on sixteen-foot centers in the bottom of the trench. These duct-form supports serve to hold the forms, or molds, for producing the duct openings, rigidly in place and in true alignment while the concrete is worked into place in the bottom of the trench.

FIG. 3.—TRENCH WITH DUCT FORMS SET.

The duct forms, or molds, consist of sixteen-foot sections of clear, straight-grained lumber previously dressed to the shape of a "U," and are held down in the duct-form supports against the buoyancy of the plastic concrete by suitable cast-iron, or other weights.

When the duct forms are set, concrete of the proper mixture for good concrete work is dumped into the trench, and suitably rammed and puddled around the forms, and finally struck off level with the tops of the molds. The concrete is then allowed to take its initial set, which in favorable weather requires about three hours, when the duct forms may be removed by simply lifting them upward and out of the concrete, leaving smooth, straight, continuous, U-shaped grooves in the bed of concrete just laid which, when covered, constitute the duct openings.

Fig. 3 shows the trench with forms set ready for the concrete to be dumped in.

FIG. 4.—DUMPING CONCRETE INTO TRENCH.

FIG. 6.—REMOVING DUCT FORMS.

Fig. 4 shows the method of introducing, tamping and puddling the concrete.

Fig. 5 illustrates the manner in which the surface of the concrete is finished off level with the tops of the duct forms.

The manner of removing the duct forms from the concrete, at the same time avoiding the presence of workmen in the trench, is shown in Fig. 6.

After the duct forms are removed from the concrete, the smooth, continuous grooves molded in the concrete by the forms are open to the daylight for the full length of the construction, and every possible facility is afforded for perfect and rapid inspection. Any faults in the work may be instantly detected, and this in itself is a potent factor in securing first-class work. Fig. 7 shows a tier of ducts immediately after removal of the duct forms and ready for the addition of the top cover or the next layer of ducts, as may be desired.

FIG. 5.—STRIKING OFF SURFACE.

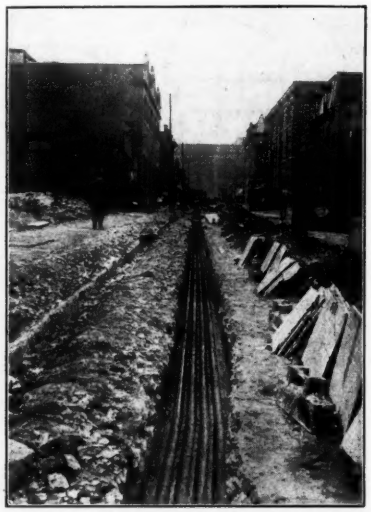


FIG. 7.—DUCTS AFTER REMOVAL OF FORMS.

FIG. 8.—SLABS COVERING DUCTS.

The open-type ducts, as illustrated in Fig. 7, are closed in by laying across the top of the structure thin, smooth plates, or slabs, of concrete molded on the site of the work, some of which are shown on the right-hand side of the picture. These slabs, or plates, of concrete are made of

just sufficient width to lap over each outside duct a short distance, and are laid as illustrated in Fig. 8, with a small quantity of mortar to perfectly seal the joints. The thin concrete slabs, or plates, serve the double purpose of closing in the top of the newly formed ducts and as a foun-

FIG. 9.—BLIND HANDHOLES.

dation, or support, for the next layer of concrete in which an additional tier of ducts may be formed in the same manner as the preceding tier; this operation being repeated as often as necessary to produce the required number of duct openings. The top of the conduit is closed in in the same manner, with the exception that the top layer of concrete contains no duct

FIG. 10.—FINISHED CONDUIT, SHOWING BLIND HANDHOLES READY FOR COVER.

forms and acts simply as an armor or envelope to protect the conduit construction from future excavators.

Monolithic conduit is especially well adapted to be used as a conduit for local distribution. "Blind" handholes, or service boxes, are readily molded in the concrete structure, intercepting any desired number of ducts, as illustrated in Fig. 9. In molding these handholes, or service boxes, the duct forms are allowed to pass through, and the concrete flowing around the duct forms is stopped off by suitable forms arranged to fit closely around the duct molds. Such handholes, or service boxes, can be installed at as frequent intervals as desired without increasing the cost of the construction, inasmuch as no additional material is required. The top of the handhole, or service box, is closed in after the conduit is finished by a suitable cast-iron or concrete cover, made loose, so as to be readily removed in case it is desired to open the box for taking off services. A section of completed monolithic conduit is shown in Fig. 10, with a handhole, or service box, open ready for the placing of its cover.

Monolithic conduit has been laid under a great variety of street conditions, and during all seasons of the year, with perfect success and with a material saving in cost over the various pipe methods of duct construction.

McCall Ferry Company Committee Plans Issuing $12,500,000 Bonds.

A plan for raising new capital to complete the enterprise of the McCall Ferry Power Company has been issued by the committee having the refinancing in charge. The committee consists of William M. Barnum, A. C. Bedford, S. Reading Bertron, Charles A. Coffin and Gardiner M. Lane.

The plan provides that either the present company be readjusted or a new company, to be known as the Southern Pennsylvania Power Company, be formed.

It is proposed to issue $12,500,000 first mortgage five per cent bonds to run thirty years. An amount not to exceed $4,250,000 of these are to be sold at ninety to obtain additional money for the completion of the works. The present bondholders will receive forty per cent of their present holdings in the new issue, amounting to $3,330,000. This will leave $4,920,000 of the new bonds in the treasury. It is also proposed to issue new capital stock to the amount of $8,500,000. Of this $3,500,000 will go as a bonus to the purchasers of the new bonds at ninety. The present bondholders will receive sixty per cent, or $4,995,000.

The new stock will be placed in a voting trust, which will terminate November 1, 1912. After that voting trust certificates will be exchangeable for stock.

Society of Automobile Engineers.

The incorporation of the Society of Automobile Engineers has been approved by Supreme Court Justice Guy. The object of the society is "to promote the arts and sciences connected with engineering and the mechanical construction of automobile vehicles; to hold meetings for the reading and discussion of papers relating to the construction and improvement of automobiles, and to promote social intercourse among its members; to publish and distribute papers and literature relating to the construction of automobiles, and to maintain an engineering library." There are to be twelve directors, and the principal office will be in New York.

The incorporators are Russell Huff of the Packard Motor Car Company of Detroit, Mich.; Andrew L. Riker, of the Locomobile Company, Bridgeport, Conn.; Henri C. Chatau, of the General Electric Company, Schenectady, N. Y.; B. D. Gray, of the American Locomotive Works, Providence, R. I.; R. C. Carpenter, of Sibley College, Cornell University, Ithaca, N. Y.; Henry Hess, of Philadelphia; F. J. Newman, of Chicago; Alexander Churchward, of 2 Rector Street, and Horace M. Swetland and Thomas J. Fay, of 239 West Thirty-ninth Street, New York city.

Boston Tech's New Head.

Dr. Richard Cockburn MacLaurin was formally inducted into office as president of the Massachusetts Institute of Technology on June 7 last. President MacLaurin, who was connected with Columbia University, actually assumed the reins of government of the Institute on June 1, succeeding Acting President Arthur A. Noyes.

Taking part in the proceedings were the following special guests: Ambassador James Bryce of England, Governor Eben S. Draper, President A. Lawrence Lowell of Harvard University, Bishop William Lawrence, President Henry S. Pritchett of the Carnegie Foundation for the Advancement of Teaching, Prof. Arthur A. Noyes, chairman of the faculty, and James P. Munroe, former president of the alumni.

Protects Transmission Wires and Poles.

Section B 243 in one of the acts passed by the last General Assembly of the Illinois Legislature fixes the punishment for the malicious injury or destruction of wires or poles used in the transmission of electric current at a fine of $500 or a year's imprisonment or both.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

PROPOSED PLAN OF DENVER GAS AND ELECTRIC COMPANY.

The stockholders of the Denver Gas and Electric Company have authorized the management to organize a new company, to be called the Denver Gas and Electric Light Company, which will take over and consolidate the various properties and subsidiary companies owned by the present company, and issue $25,000,000 general mortgage five per cent bonds. The action is taken owing to the necessity of providing for the capital requirements of the company's rapidly growing business and with a view to an ultimate extension of operations. Of the total $25,000,000 bonds, $7,500,000 will be set aside to retire the present outstanding bonds of the company and the remainder will be sufficient, it is expected, to provide for the needs of the company for a long period of years.

THIRD AVENUE REORGANIZATION PLAN.

The reorganization plan of the Third Avenue Railroad properties, New York city, is well under way and will be announced within a few weeks, despite the fact that the properties are not to be sold until next fall.

In the plan of reorganization bondholders will be asked to authorize an expenditure of $7,500,000. One million dollars of this will probably be spent for new tracks. Of the remainder, $2,500,000 will be employed to take up the receiver's certificates issued by Frederick W. Whitridge, the Federal receiver, appointed by Judge Lacombe to take charge of the property. This money has been spent by the receiver for improvements and betterments during his term of office.

The other $4,000,000 will be spent for other purposes, for just what is not stated, although it is believed that it will cover further expenditures for car barns, rolling stock and other improvements.

METROPOLITAN SELLS SECURITIES.

The New York City Railway and the Metropolitan Street Railway have sold to William A. Read & Company, of New York, a new issue of $3,500,000 four-and-one-half per cent receivers' certificates, maturing June 15, 1910. These certificates are a first and paramount lien upon real estate, assesed in 1907 for $6,445,000, and are issued to take up an equal amount maturing June 15 next. The bankers are offering the certificates for subscription at 100¼, at 4.25 per cent income basis.

The new issue of receivers' certificates are dated June 15, 1909, and run for one year. They bear interest at four-and-one-half per cent, and are to take up a similar issue maturing this month, but bearing interest at five per cent. W. A. Read & Company have purchased the certificates jointly with the Central Trust Company.

CHICAGO RAILWAYS REHABILITATION.

The rehabilitation of the Chicago Railways Company has taken all the funds secured from the $6,000,000 five per cent mortgage bonds sold to the Harris Trust Company, of Chicago, and the National City Bank, of New York, on March 1, and the same banks will take an equal amount about August 1 at the same price by previous arrangement. This will cover the remaining rehabilitation required by the ordinance by February 1, 1911, which the management expects to finish by January 1, 1910.

The company has let a contract to the Pullman Company for 350 more cars, making a total of a thousand pay-as-you-enter cars due by December 1. Earnings since November 1 have gained over sixteen-and-one-half per cent, last month's increase being $147,000.

AMERICAN CITIES RAILWAY AND LIGHT COMPANY.

The American Cities Railway and Light Company's report for the fiscal year ended December 31, 1908, compares as follows: Income account:

	1908.	1907.
Total income	$547,897	$527,122
Expenses and taxes	29,501	17,348
Net earnings	$518,396	$509,774
Preferred dividends	414,366	414,370
Surplus	$104,030	$ 95,404

Combined income account of controlled companies compares as follows:

	1908.	1907.
Gross	$5,435,494	$5,437,796
Expenses and taxes	3,280,248	3,371,703
Net	$2,155,246	$2,066,093
Interest charges	1,228,215	1,140,662
Surplus	$ 901,531	$ 910,089
Dividends	617,176	604,676
Net surplus	$ 284,355	$ 305,413

LONDON UNDERGROUND.

The Underground Electric Railways of London report gross earnings for the week and nineteen weeks ended May 15, 1909, compared as follows:

	1909.	1908.
Bakerloo	£ 3,110	£ 3,120
Picadilly	5,715	5,565
Hampstead	3,880	3,360
District	10,018	9,078
Tramways	6,158	6,852
Total	£ 28,881	£ 27,975
Total nineteen weeks	533,019	497,210

UTICA & MOHAWK VALLEY.

The report of the Utica & Mohawk Valley Railway Company for the quarter ended March 31, 1909, compares as follows:

	1909.	1908.
Total railway operating rev.	$260,926	$236,239
Total railway operating exp.	167,007	152,300
Total net revenue from oper.	$ 93,919	$ 83,939
Taxes accrued	17,609	9,860
Operating income	$ 76,309	$ 74,078
Other income	614	4,142
Gross income	$ 76,924	$ 78,221
Total deduc. from gross income.	54,971	42,063
Net corporate income	$ 21,953	$ 36,157

METROPOLITAN STREET RAILWAY.

An abstract of the quarterly report of the receivers of the Metropolitan Street Railway for the first three months of 1909, made public by the New York Public Service Commission, shows a substantial increase in income as compared with the corresponding period of 1908.

The gross earnings for the quarter ended March 31, 1909, were $2,927,503, as against $3,360,345 in the same quarter in 1908, but in the same period operating expenses were reduced from $2,913,319 to $2,036,103, and fixed charges from $996,674 in the quarter ended March 31, 1908, to $975,247 in the corresponding quarter of 1909. Thereby a deficit after payment of interest and rentals amounting to $421,793 for the three months ended March 30, 1908, was changed into a surplus of $24,044 for the same period of 1909.

THIRD AVENUE RAILROAD.

Figures on the operation of the Third Avenue system, New York city, for the quarter ended March 31 last show a gross income of $1,360,703, a gain of $187,855 over the quarter ended March 31, 1908. Operating expenses in the same quarter of 1909 were $1,109,860, an increase of $171,428. A slight increase in miscellaneous income brought the gross income of the Third Avenue Road up to $417,693, an increase of $68,960 over the same quarter in 1908. Receiver Whitridge had $240,235 to pay the fixed charges, a decrease of $80,049 from the same quarter of last year. He therefore came out with a net income for this quarter of $177,457, which, added to previous net of $750,772, made a total surplus of $928,230 for the nine months ended March 31, 1909.

Receiver Whitridge says the Third Avenue Bridge Company, recently incorporated at Albany, with $100,000 capital, is backed by Third Avenue Railroad Company, to operate a line across the Queensboro Bridge.

QUESTIONS AND ANSWERS.

LIGHTNING ARRESTERS AND CABLE TROUBLES.—(1) How far apart should lightning arresters be placed on a 220-volt, direct-current, multiple pole line and how should they be put on, one on each side of the line? (2) Most of our system is underground. I have had several cases of grounds on the underground cables, which on examination showed no signs of deterioration of the lead sheath. On splitting off the lead we found several small holes through the rubber insulation, the copper showing signs of being burned. The only thing I could make out of it was that it was a static discharge of lightning. Am I right?—M. A. L., Peoria, Ill.

(1) For low-voltage distributing lines it has been found best to place lightning arresters about 2,000 feet apart on each side of the line and closer together at especially exposed points, or where important transformers are located or at branching points of the line. (2) The grounds discovered on the cables are very likely due to surges on the system rather than to outside lightning discharges. Surges are excess potentials, sometimes several times the normal voltage of the line, that are caused by sudden and great load fluctuations, switching operations, grounds or short-circuits on the system. Their effects are similar to lightning effects; in fact, Dr. Steinmetz calls them "internal lightning." Such excess potentials frequently break down the insulation between the copper conductor and the grounded lead sheath at the weakest spot of the insulation. Such spots are likely to develop where, during the manufacture of the cable, minute particles of metal have become imbedded in the insulation.

AUXILIARY PLANT FOR PEAK LOAD.—Our steam-driven lighting plant is overloaded. Any steam extension would require a new boiler, engine and alternator. The present plant will carry the load (except at the peak about three hours every night) for several years. To supply the peak demand will require thirty kilowatts until we can connect with a hydroelectric plant. Coal costs $3.40 a ton. Do you advise using a crude-oil engine to carry this thirty-kilowatt peak.—C. L. P. C., Lenoir, N. C.

In making provision for auxiliary plant for temporary peak-load service the question of low investment charge for the added equipment should receive greater consideration than its efficiency. That is, the additional installation should be of the cheapest possible kind consistent with reliability. Therefore, in this particular case, if city gas at a reasonable figure, say, not over $1 per 1,000 cubic feet, is available, a gas engine should be the first choice on account of its low first cost, reliability and small attention required in operation. If natural gas is available, however, an engine suitable for it would be the most desirable unit for low fuel and operating costs. A crude-oil engine should be selected in case a gas engine cannot be used; it is not so reliable, however, and requires more attention. In any case an internal-combustion engine would be cheaper to install and operate for this service than an additional steam boiler and engine.

SPEED OF RAILWAY TRAINS.—In an argument that I had with a locomotive engineer, he contended that higher speeds have been attained and are possible with a steam locomotive than with electric railways, while I held the contrary view. He also claimed that speeds over 100 miles an hour are not feasible. Is he correct or am I?—J. O. R., South Bend, Ind.

The highest railway speed ever attained was that developed in the famous high-speed electric-railway tests conducted in 1902-03 at Zossen, near Berlin, Germany. Speeds up to 130 miles per hour were attained by electric-motor cars without great difficulty. These tests proved conclusively that electric railways can be constructed for any desired speed up to and even beyond this figure, if sufficiently powerful motor equipments are provided. In other words, the steady torque and compactness of the electric motor adapt it to much higher speeds than are attainable with a reciprocating steam engine. It was also demonstrated that, while such high speeds are perfectly feasible with electric traction, they are extremely expensive in any case on account of the high equipment and power costs. For example, it was shown that the wind resistance to be overcome varied as the square of the speed; also that the track and roadway must be of the most perfect and rigid construction. For present traffic conditions there are very few railways that have sufficiently great income to warrant them in rebuilding the entire roadway, straightening curves, reducing inclines, strengthening bridges, eliminating crossings and laying down massive trackwork that are essential for regular service at speeds in excess of 100 miles per hour. However, the time may come soon when the traffic between two such great centers as New York and Chicago may become so great as to warrant the expenditure of many millions of dollars for the attainment of the highest speed service. The engineering requirements will offer no insurmountable obstacles. High speed, therefore, is entirely feasible with electric traction; it is merely a question of finances that must be solved.

DEPRECIATION OF ELECTRIC-RAILWAY EQUIPMENT.—Kindly inform me what is the approximate depreciation on the following: Power-house generating equipment, rolling stock, line construction (wooden poles) and track. Kindly give detailed figures, if possible, and also the per cent maintenance.—C. T. P., San Francisco, Cal.

The amount that should be allowed for depreciation of the physical property of an electric railway is an unsettled question that depends on the character and the manner of installation of the original equipment as well as on the severity of service and the degree of maintenance that the property receives. The following may be taken as conservative average percentages of the first cost of the various items of equipment to be set aside as an annual reserve to the depreciation fund for the renewal of these items:

Power House.	*Per cent.*
Boilers and settings	8 to 10
Pumps	5 to 8
Piping	3 to 6
Engines	3 to 7
Dynamos and electrical apparatus	2 to 5
Line construction.	
Transmission and feeder lines	5 to 12
Trolley	6 to 15
Track.	
Rails and ties	8 to 15
Special work	10 to 20
Bonding	7 to 12
Rolling Stock.	
Car bodies and trucks	5 to 7
Electrical equipment	6 to 10

A feature to be noted is that depreciation estimates should provide not only for wear and tear, but also for obsolescence of the equipment, as well as probable inadequacy and possible extraordinary casualties. In view of these considerations the figures above may be none too liberal. The allowances for maintenance vary a great deal more even than those for depreciation; moreover, they vary from year to year, as it becomes necessary to make more or less extensive repairs to different parts of the equipment to keep it in reasonably good operating condition. It is the practice with many companies to deduct from the depreciation reserve those amounts expended in maintaining the property. In this case as a general average the percentage of the total depreciation reserve expended in maintenance is from forty-five to sixty per cent. Depreciation has just recently been receiving proper attention.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

THE ROTTERDAM-HAGUE-SCHEVENINGEN ELECTRIC RAILWAY.

The Rotterdam - Hague - Scheveningen single-phase railway, which was built to operate at high speed under a tension of 10,000 volts, was completed in October, 1908, and forms an important step in the electrification of main railways. The length of this double-track line is about thirty-three kilometres, and the entire track length is about seventy-five kilometres. Express trains stop only at the three main stations; for local traffic a number of other stations have been built. The power station has been erected at Leidschendam in the vicinity of the railway and also of a navigable river, so that fuel and supplies may be received by water. The boiler installation comprises five boilers having a normal capacity of 3,000 kilogrammes, and a maximum capacity of 4,200 kilogrammes of steam per hour each at ten atmospheres and 300 degrees Centigrade superheat. In the engine house three generating sets have so far been installed; the fourth is being erected. Two of the sets consist of directly-coupled horizontal engines and flywheel dynamos of a maximum capacity of 850 kilowatts; the other two sets are turbine generators of 2,000 kilowatts each. All the generators furnish polyphase current of twenty-five periods at 5,000 volts, which is transformed into two-phase current of 10,000 volts by six transformers with Scott connection. The high-tension switching installation is arranged so that all the high-tension conductors and apparatus are entirely separated from the low-tension part and contained in a special room. The oil switches, lightning arresters and protective devices are enclosed in separate concrete cells in the same room. The switches are operated by small direct-current motors, which can be controlled from the main switchboard. There are three main busbars, each of the two outer ones being connected to one of the overhead lines and the middle one to the rails. The entire overhead line is divided into two sections insulated from each other, and each section is connected to one phase. The separation of the phases is carried out near Pynacker station and the location has been chosen so that under ordinary conditions the load on both phases is nearly equal. The trolley wires are hung by the multiple-suspension method patented by the Siemens-Schuckert Works. On account of the unfavorable soil conditions all the poles had to be placed in concrete foundations. The rolling stock at the present time consists of nineteen motor cars and nine trailers built on the lines of an American model. During the winter fifty-two trains have been run daily, and in the summer, during the Scheveningen bathing season, the number is to be increased to 144 per day, which will make the distance to be traveled by each motor car about 576 kilometres per day. The trains are usually made up of two motor cars and two trailers, and are capable of attaining a speed of seventy kilometres per hour. The operation of the road since its opening has been perfectly successful.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), May 6 and 13.*

WIND-POWER ELECTRIC INSTALLATIONS.

The Oerlikon Company has constructed a wind-power motor for producing electrical energy in small generating stations. In order to save an attendant, the installation is designed to operate automatically in all its parts, and only in violent storms is it necessary to adjust the working surface of the wind-wheel. The electrical part of the installation includes a storage battery, which furnishes current during periods of wind-calm, or whenever the windmill stops. An automatic tension regulator is used to maintain a constant pressure in the light circuit. The dynamo has the property of furnishing an absolutely constant pressure to the busbars of the lighting network, independently of its number of revolutions and of the condition of the charge of the battery, while at the poles of the machine, between the minimum and the maximum number of revolutions, the pressure rises from the discharging to the charging tension of the battery. The speed of the dynamo may vary up to a definite maximum value, and the connection and disconnection of the battery takes place automatically when the proper conditions arise, at no current intensity, so that there is no injurious sparking at the breaking points. The maximum number of revolutions of the machine controls the maximum admissible speed of the windmill, and thus the highest charging tension cannot be exceeded. The charging current becomes the smaller the more the charge progresses, and when the battery is completely charged the tension ceases, although the windmill continues to run. When in consequence of high wind velocity the energy produced by the motor becomes more than necessary for charging the battery, the speed of the motor merely increases to the maximum permitted by the regulating device, but the tension of the dynamo does not rise above a certain maximum value. The installation contains no unreliable mechanical apparatus. The tension regulator is based on the Thury system.—*Translated and abstracted from Zeitschrift des Oesterr. Ingenieur und Architecten Vereines (Vienna), May 21.*

THE POPULARIZATION OF ELECTRIC LIGHTING.

The introduction of metal-filament lamps has made electric light about as cheap as that produced by petroleum, and there can be no doubt that electricity would quickly displace petroleum, even at the present price of about ten cents per kilowatt-hour, if it could be bought in shops in small quantities and burned in cheap lamps, like the latter, says E. Wikander. The chief obstacle against the introduction of electric light is no longer its high price, but rather the cost of the installation. As a means of overcoming this difficulty, the author recommends that the central station make the installation at its own expense, for which it might reimburse itself in various ways, as by charging a price slightly above the normal for the current, or by having the consumer guarantee a certain minimum consumption during the first few years, which should be sufficient to cover at least the cost of the installation and the cost of producing the current. But if electric light is to be introduced among all classes of people, another method of payment than that generally used must also be adopted. It would not be possible to install expensive meters for consumers using only a few lamps and to collect small amounts from tens of thousands of cus-

tomers. The only practicable system under these conditions seems to be one under which the consumer pays a fixed sum, and is entitled therefor to a certain definite number of lamps. Collections might be made by the landlord, together with the rentals, which might eventually be made to include the lighting. In conclusion, the author states that the authorities would have god reason to compel the adoption of electric light in thickly populated places for sanitary reasons. An incandescent gas burner uses as much oxygen as four persons, and an ordinary petroleum lamp still fifty per cent more. The substitution of electric light would therefore have the same effect, with respect to the oxygen, as if the cubic contents of the room had been doubled.—*Abstracted from Elektrotechnische Zeitschrift, May 20.*

ELECTROLYTIC CONDENSERS OF LARGE CAPACITY.

Large paper, glass or mica condensers are expensive, and the employment of electrolytic condensers will therefore be found of advantage where the leakage of current is of no importance. These condensers, which are easily prepared, consist of electrodes of aluminum, magnesium or tantalum (preferably the cheap aluminum), immersed in a liquid. Under the action of the current these metals are covered by a thin, very porous layer of oxide, and in the pores there forms itself a gaseous skin which separates the metal from the electrolyte and constitutes the dielectric of the condenser. The gaseous skin offers a high resistance to the passage of the current, and its thickness increases with the difference of potential up to a certain limit, corresponding to the critical tension, at which sparks will pierce the dielectric, and the current will pass. Gunther Schulze has made an exhaustive investigation of this subject and gives the critical tensions for several metals; for aluminum in different solutions he has found them to be as follows:

	Volts.
Sulphate of soda	40
Permanganate of potassium	112
Bichromate of potassium	122
Silicate of soda	415
Citrate of ammonia	470
Borate of soda	480
Citric acid	535

The capacity of a condenser of this kind does not depend on the electrode, but only on the nature of the metal employed and the tension under which the dielectric skin was formed. Of all the liquids experimented with, borates showed the least leakage and the greatest constancy of the gaseous layer. Boracic acid of ammonium, which has a critical tension of 403 volts, seems to be the most recommendable. The capacity obtained is considerable; for instance, a condenser with aluminum electrodes of a surface of 1,400 square centimetres each, charged at 100 volts, showed a capacity of sixty microfarads for each electrode. The loss of current is very small, only 0.05 at ninety volts, but it increases with the tension and time. Condensers of this kind connected in series have been successfully employed on distributing lines as a protection against overtensions. The number of condensers to be joined in series is determined by taking into consideration the critical tension of each condenser and then employing a sufficient number so that under normal conditions this pressure is not reached, but if an overcharge occurs, it can escape freely by breaking down the dielectric.—*Abstracted from L'Industrie Electrique (Paris), May 10.*

THE RADIOGONIOMETER.

The object of this communication is to show the results obtained with the radiogoniometers of transmission and reception in order to prove by experimental data the theory advanced in the course of a lecture by E. Bellini and A. Tosi, in 1908. The results arrived at by the authors are as follows: (a) The current intensities in the aerials connected to the radiogoniometer of transmission follow rigorously the sinusoidal law; (b) the polar diagram of these current intensities is formed exactly by four equal circumferences, tangent two by two; (c) the direction of the indicator of the radiogoniometer of transmission is always rigorously that of the maximum radiation; (d) the electromotive-forces induced in the movable coil of the radiogoniometer vary rigorously according to the sinusoidal law; (e) the direction of the maximum intensity of reception shown by the indicator of the receiving radiogoniometer is always exactly the same as that of the transmitting station. The authors also remark that, in view of the obligatory wave length fixed by the Berlin Conference, syntony has lost much of its importance, and it may now be said that only directed waves will insure the greatest possible secrecy of communication and independence of stations.—*Translated and abstracted from Atti della Associazione Elettrotecnica Italiana (Milan), January and February.*

THE LAW OF SUPPLY AND DEMAND.

In the present condition of the electrical industry the principle of supply and demand no doubt affords some explanation of the loss in trade, and its applicability must be admitted, but it is obvious that prices are governed by circumstances far more complex than those that fall easily within the limits of that simple principle. For example, while the output of india rubber is rapidly growing, the price is being maintained at a high figure that seems to be only partially accounted for by the rate of increase in demand. And again, notwithstanding the increasing demand for aluminum, the price of the metal has steadily fallen toward the point which enables it to compete with copper. In both of these cases the quality has been maintained and even improved. In each of these cases the principle of supply and demand applies, but it applies only when secondary factors such as quality, competition, financial enterprise, climatic influences, and area of production are taken into account. The lesson seems to be that manufacturers must look more carefully to the sources of supply and they must seek to control, if not to own, enough of those sources to enable them to hold a favorable position. —*Abstracted from the Times (London) Engineering Supplement, May 26.*

ELECTRIC LAUNDRY ON SHIPBOARD.

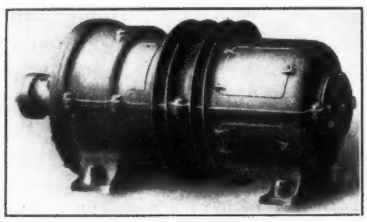
The twin-screw steamer Otway, the second of the five new steamers being built for the Australian service of the Orient Steam Navigation Company, has recently been completed. This splendid 12,500-ton vessel has among her modern equipments an electric laundry which is briefly described below. Taking the appliances in the order of their use, there is, first, a cylindrical tank in which the water is maintained at the boiling point by a steam-pipe coil. Thence the water is run to one or other of the two washing machines of the drum-rotating type. The washing machines are both driven from one shaft to which is coupled an electric motor on the deck above. Drying is accomplished by a self-balancing hydro-extractor which is driven by belting at 640 revolutions a minute from a two brake-horsepower electric motor. In addition to hand-ironing benches, there is a Decoudon machine driven by a two brake-horsepower electric motor. If the operator's fingers advance too far toward the roller, a plate acts through a lever and stops motor. The body of the machine is heated internally by steam of fifty pounds pressure, and the roller by steam of ten pounds pressure. A special collar-and-cuff ironing-machine is provided, and electric irons are used on the several hand-ironing tables. *Abstracted from Engineering (London), June 4.*

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Westinghouse Headlight Turbine-Generator Set.

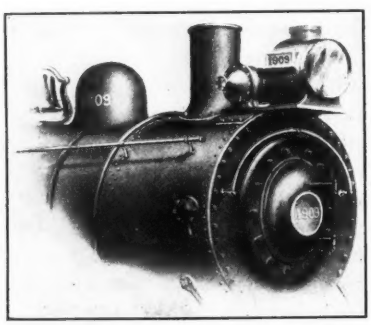
Designed with a special view to the simplicity of operation and ruggedness of construction required in electrical apparatus to be placed in charge of men untrained in its supervision, the new Westinghouse head-lighting turbine-generator set approaches almost the ideal of small



WESTINGHOUSE TURBINE-GENERATOR HEADLIGHTING SET.

power-plant operation, since the engineer has little else to do than open the steam valve, depending on the excellent inherent qualities of the machine for successful continuous operation without further attention.

The new Westinghouse head-lighting outfit, illustrated in an accompanying



WESTINGHOUSE ELECTRIC HEADLIGHTING OUTFIT.

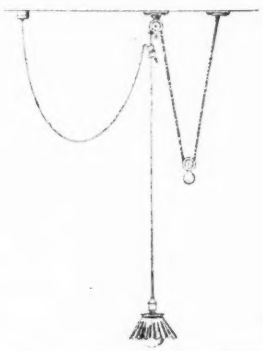
sketch, is being exhibited for the first time at the Master Car Builders' and Master Mechanics' conventions in Atlantic City, June 16 to 23. It is a compact combination of steam and electrical elements, of minimum size and weight, and is especially enclosed, so as to be weatherproof, for mounting on the locomotive boiler shell. One of the illustrations shows the turbine-generator set (which measures only twenty-five inches over-all shaft length and thirteen inches in diameter) mounted on the locomotive directly behind the headlight, an arrangement which groups all the parts of the headlight system closely and out of the way.

The steam element or turbine is of the impulse type, employing a re-entrant path for the steam which undergoes almost its total expansion directly at the nozzles. A shaft governor of special design controls directly a throttling valve in the steam-admission line.

The generator element is rated at three-fourths kilowatt, supplying twenty-five amperes at thirty volts. It is of the two-pole type, and its high rotative speed makes possible a design of least size and weight of electrical parts. The entire rotating element is carried on ball bearings, and all parts of the train-lighting outfit are amply protected against injury from moisture or weather conditions. Standard head-lamps complete will be furnished, or the arc mechanism may be arranged for insertion in any head-lamp case which has been used for oil or other illuminant.

The "Eclipse" Lamp Adjuster.

J. W. Carter & Company, Abilene, Texas, have placed on the market the "Eclipse" Adjuster, an illustration of which is shown herewith. This adjuster is made entirely of metal and comprises two component parts, a fixed and a loose pulley with counterweight. One of the



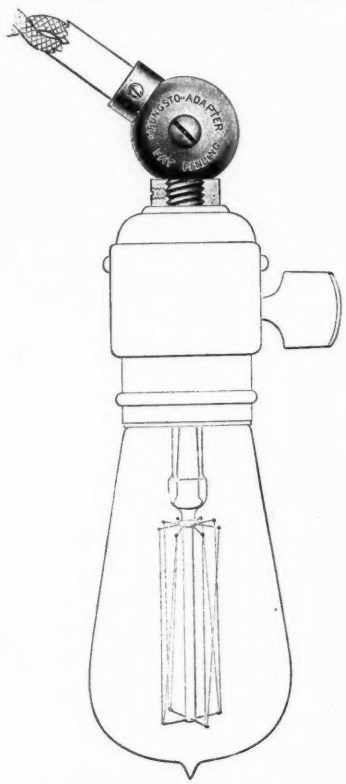
THE "ECLIPSE" LAMP ADJUSTER.

parts of the adjuster is simply a metal frame two-and-three-quarter inches in diameter, carrying a pulley and equipped with a wood-screw. This part is screwed into the ceiling and the cord passed over the pulley, the counterweight being interposed between the fixed pulley and the terminal of the cord.

Each part of the adjuster is arranged so that by removing one screw the pulley works on the principle of a snatch-block, allowing the adjuster to be installed without removing the lamp from the cord.

The counterbalanced sheave weighs about twenty-one ounces, and is equipped with a hollow metal ball two-and-one-quarter inches in diameter, which may be loaded with shot to increase its weight. The frame carrying the pulley is two-and-three-quarter inches in diameter.

These adjusters have been installed with the reinforced cord passing over the



TUNGSTO ADAPTER.

fixed pulley and supporting the counterweight from the rosette. This plan is not approved by the underwriters, however, and it is only sanctioned where an auxiliary cord is used, the portable reinforced cord not coming in contact with the pulley.

The "Tungsto" Adapter.

The tungsten lamp, on account of its construction, should be hung with the large end of the bulb pointing downward.

Many lamp fixtures are so made that, while an ordinary incandescent lamp may

be used without trouble, the tungsten lamp, if applied direct to the fixture, would rapidly deteriorate and ultimately become useless through the breaking of the delicate filament.

By the use of the "Tungsto" adapter, the tungsten lamp may be used with any style of fixture, the lamp being held rigidly in the proper position.

The "Tungsto" adapter permits instant adjustment of the lamp without distortion or bending of the lamp fixture and presents a neat and ornamental appearance when in position.

The "Tungsto" adapter is finished in old brass, polished brass, nickel plated and oxidized copper to suit the requirements of users. The Frank Mossberg Company, Attleboro, Mass., is the manufacturer of this device.

Marshall Sign Receptacles.

The Marshall Electric Company, Hyde Park, Mass., has just put upon the market a complete set of sign receptacles that

FIG. 1.—FOR SEALING WIRES TO THE BACK.

are said to be a considerable improvement over most of those used for this particular purpose.

FIG. 2.—FOR USE WITHOUT SEALING WIRES.

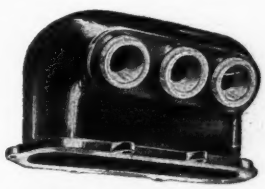
The general exterior appearance is very like that of the sign receptacles used before, but many of the older types have

FIG. 3.—FOR WOODEN SIGNBOARDS.

frequently failed in weather conditions owing to the corroding of the screw shells. These Marshall sign receptacles are provided with copper screw shells, which entirely eliminate any possibility of such a drawback. Moreover, the center contact is an elastic spring, and is well separated from the other parts by a mica washer. Fig. 1 is for metal signs and for sealing the wires in the back. Fig. 2 is a small metal sign receptacle used where no sealing of wires is required. Fig. 3 is intended for wooden signboards.

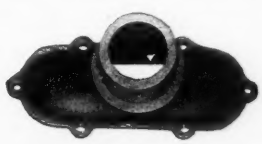
"Noark" Fuse and Service Boxes with Interchangeable Conduit Fittings.

The H. W. Johns-Manville Company, New York city, make a complete line of fuse and service boxes taking fuses from one to 600 amperes. The novel feature of these boxes is that they may be used either in open wiring or for conduit work. Where the boxes are to be used in conduit work, it is only necessary to attach any one of a number of different styles of conduit fittings, which are arranged for that purpose.



CONDUIT FITTING.

The service boxes are so arranged that the fuses may be withdrawn when the cover of the box is opened, or they may be left in their contacts at the will of the operator. These boxes are designed



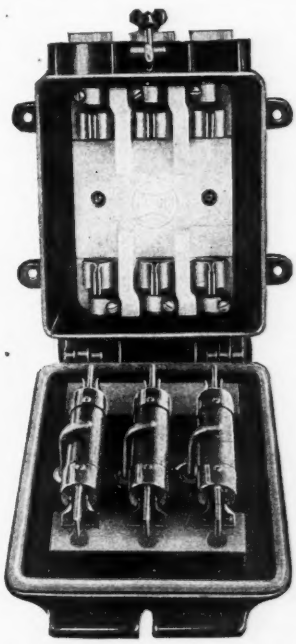
INTERCHANGING FITTING.

to be used both as cut-outs and switches, and where they are used it is unnecessary to install a separate switch. The service boxes are watertight, and may be used with equal success in manholes or above ground for the protection of lighting and power services. The mechanism used to cause the fuses to be withdrawn with the cover is operated by a single handle on the outside of the box, one-quarter turn of which engages the fuses.

A Convenient Receptacle and Box.

Security, adaptability and convenience have prompted the construction of recent forms of outlet boxes suitable for various forms of conduit. Among the best known of these devices are the Sprague multilets that were described in these columns in the issue of May 8. The accompanying illustrations show the Sprague Multilet with the special receptacle cover No. 6309 and also the G. E. receptacle No. 60931, which can also be seen in the box.

Unlike many other sign and outlet-box receptacles, this one is particularly adapt-



NOARK WATERTIGHT FUSE BOX.

able to Sprague Multilets, for the reason that the screws securing the wire connections to the clips of the receptacle are tightened from the face of the receptacle and not from the back. This obviates the necessity of having long wires within the box, an advantage which will be quickly appreciated by the wireman.

G. E. SIGN RECEPTACLE.

The Messenie Flaming-Arc Lamp.

The high efficiency and high intensity of illumination of the flaming-arc lamp has brought about its rapidly extending use where brilliant lighting is desired. Although the energy consumption of this lamp is relatively low, the cost of the carbons and the trimming of them is quite high. It has been the aim of inventors for some time to reduce these costs, and it is believed that, if this is accomplished to a reasonable degree, the use of these lamps for regular street-lighting service will receive a great impetus.

To increase the life of the carbons above

eight or nine hours it is almost invariably the custom to make them of great length. This not only makes the lamp case very long, but further increases the cost of the carbons and their liability to breakage. It has been proposed to use a magazine holding several sets of carbons, so that as one set is used up another automatically replaces it. A lamp of this kind has been built abroad, which, however, is rather complicated.

An American inventor, Paul A. Messenie, of Chicago, has perfected this idea and built a lamp which is both simple and compact. In this lamp twelve-inch carbons are used, and they are

MESSENIE FLAMING-ARC LAMP.

mounted in sets in a rotatable framework resembling an inverted truncated cone. Each set has its two carbons inclined with the carbon tips projecting through the base of the framework. In the form of this lamp now built there are four sets of carbons, but it can be designed for five, six, or even more sets.

The lamp mechanism is very simple. The means for striking the arc and for feeding down the carbons are along lines found effective in the best practice with this class of arc lamps. The feeding mechanism is under the control of a series magnet and dashpot. Near the bottom of each set of carbons is a small series magnet for deflecting the arc downward.

When a set of carbons is nearly consumed an extension from the clip engaging the upper end of one of the carbons makes contact with a stationary terminal of a circuit including a release magnet connected for an instant directly across the lamp terminals. This magnet releases a catch that normally keeps the framework from rotating, and thus permits a strong spring to turn it so as to bring the next set of carbons into play. By this action these carbons are immediately connected into the circuit, the time from the extinguishment of the arc to its re-establishment being less than one second. The entire change from one set of carbons to the next is not only rapid but positive, the spring having power enough to turn the framework through several complete rotations. There is no possibility of the mechanism sticking, nor is there of destructive arcing, since the circuit is quickly and completely broken during the change from one set of carbons to the next. The carbons are consumed to but a very small part of their original length. A marked saving results from this feature alone.

In trimming the lamp it is not necessary to remove the shell, as the carbons can be inserted from below. This saves considerable time and permits the lamp to be trimmed in all kinds of weather without exposure of the mechanism. During trimming the carbon-holding framework is given a complete turn, which winds the spring referred to above.

Ventilation of the lamp has been adequately provided for. The entire construction is of rugged character, not easy to get out of order. An idea of the compactness of the lamp can be obtained from the accompanying illustration. The patents covering its details are controlled by Paul A. Messenie and William E. Slaughter, of Chicago, who have formed the Messenie Electric Company. This company is about to manufacture and market these lamps.

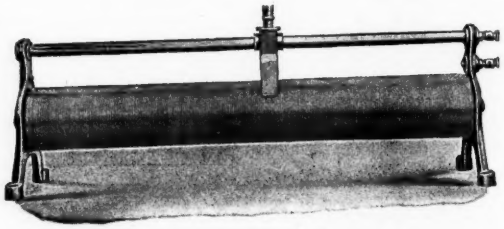
A New Line of Adjustable Rheostats.

The Central Laboratory Supply Company, Lafayette, Ind., has recently placed on the market a line of adjustable rheostats, adapted especially for meter testing, photometry work, lamp manufacture and other purposes where a continuous and close regulation of current is required. The rheostats are characterized by their simplicity, light weight, wide range and large number of steps. The accompanying illustrations present several views of these rheostats.

The complete line covers several hundred rheostats of different capacities and resistances, so that sizes can be selected for almost any purpose desired. The resistance wire is wound on a sheet-metal cylinder which has been previously covered with a thin layer of fireproof insulating material. The wire is wound under tension, and is afterward enameled, which,

END VIEW OF ADJUSTABLE RHEOSTAT.

combined with the elasticity of the insulating material, keeps the wire tight at all temperatures. The tube is mounted on ornamental cast-iron brackets placed at the ends, and held by a bolt passing through the tube. The openings in the brackets admit of a passage of air through



SIDE VIEW OF ADJUSTABLE RHEOSTAT.

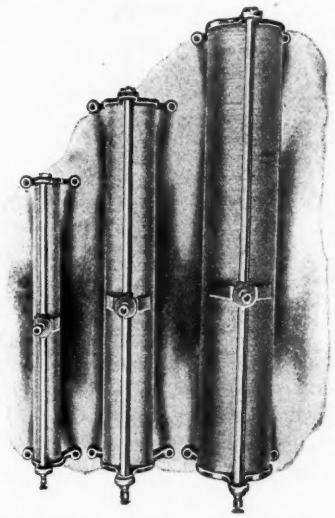
the tube, which materially assists in the radiation of heat. The feet of the rheostat are fitted with rubber tips to prevent marring the desks or tables. They are also drilled through and countersunk, so that the rubber tips can be removed and the rheostats mounted in either a horizontal or a vertical position, and fastened with screws. A round bar extends the full length of the tube and carries the sliding contact, which is of special design. The contact portion is made of a number of thicknesses of thin copper and the tension applied by a phosphor-bronze spring, so that there are several independent contacts present on the wire at all times. The contactor is fitted with an insulated handle, and the sliding mo-

tion is smooth and even, making it possible to make accurate adjustments without difficulty. Two brass binding posts, mounted on the frame, are connected to the ends of the resistance coil, and the third to the contactor. This arrangement makes it possible to use the rheostat as a series resistance or to place it across the circuit of a given potential and obtain between one end of the coil and the contactor any value of electromotive-force from zero to the voltage across the coil. These rheostats are made in three sizes:

Size A, length, sixteen inches; diameter of tube, one-and-one-half inches; weight, two-and-three-fourths pounds.

Size B, length, twenty inches; diameter of tube, two-and-three-fourths inches; weight, six pounds.

Size C, length, twenty-four inches; diameter of tube, four-and-one-half inches; weight, ten-and-one-half pounds.



TOP VIEW OF ADJUSTABLE RHEOSTAT.

The three sizes are made in capacities from one-half ampere to fifteen amperes.

Size A, in resistances of one-half ohm, with sixty steps to 525 ohms and 575 steps.

Size B, one ohm and eighty steps to 1,200 ohms and 650 steps.

Size C, four ohms and 135 steps to 2,000 ohms and 735 steps.

The wire with which these rheostats are wound has a negligible temperature coefficient, and is guaranteed not to deteriorate under repeated heating and cooling. The contactor, rod and binding posts are polished and lacquered; the rest of the parts, including the coil, are finished in black enamel. These rheostats are to be found useful for commercial and technical laboratories for controlling currents, calibrating instruments, and in various lines of commercial and experimental work.

An Improved Type of Electric Flatiron.

The increasing demand for electric flatirons has resulted in the production of many different designs.

The Central Electric Company, Chicago, Ill., has made a careful investigation of the different irons, securing authentic data as to the operation under actual service conditions, and these researches, together with those of the factory engineers, have resulted in marketing of the "Universal" type of iron.

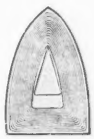


FIG. 1.

FIG. 2.

As the efficiency of an iron is that proportion of the electric energy flowing into the iron which manifests itself as useful heat on the bottom or at the ironing surface, complete tests were made by a method which measures the heat given off from the bottom of the iron only, ignoring that part given off by the other surfaces, as heat at these latter points serves no useful purpose in ironing.

The results of these tests of the Universal iron give the efficiency as sixty per cent, with a current consumption of 400 watts for the six-and-one-half pound size. It took two minutes to heat the bottom plate up to 250 degrees Fahrenheit, the temperature at top at the same time being seventy-two degrees, while a temperature of 500 degrees was attained in five minutes and the temperature at the top rose to 150 degrees at the same time. This

FIG. 3.

is a most excellent performance, and one not likely to be equaled, much less excelled.

To iron damp or wet goods effectually and quickly it is essential that the nose, or point, of the iron be hotter than the center, for the reason that the nose, first coming into contact with the wet goods, tends to cool, and by keeping this part of the iron at an initially high temperature the cooling action is not so pronounced that the point of the iron under working conditions becomes cooler than the other surfaces of the iron. If this feature were not taken care of by proper design the point would cool to such an extent that the speed of ironing would be materially reduced.

In the Universal iron the desired heat distribution is secured by so locating the heating element that the edges and points of the ironing plates are initially hotter

FIG. 4.

than the center. The location and construction of this improved heating element is clearly shown in Fig. 1 and the heating effect is illustrated by the well-known burned paper diagram, or "scorch proof," as in Fig. 2.

Fig. 3 illustrates the improved iron, and Fig. 4 illustrates the various elements. It will be noted that the heating element is firmly clamped between the body of the iron and the ironing plate,

FIG. 5.

which in the illustration is shown in the reverse position, illustrating the method by which it is bolted to the upper element. Fig. 5 illustrates the method of operating the heat-regulating switch, by the use of which the operator can keep the iron at a definite temperature, with a minimum consumption of energy.

The Sale of an Old-Established Electrical Supply House in St. Louis.

One of the oldest electrical supply houses in the Central West, the Ewing-Merkle Company, of St. Louis, Mo., will shortly sell its stock and good-will at either public or private sale. This company, it is stated, has an exceptionally strong grip on the distributing trade in the states around St. Louis. The idea is to sell for all cash or a small cash payment and notes, and it would appear that this offers a fine opportunity for one or two active young men, who could get control of this concern for a comparatively small cash payment. The matter is being handled by Ira E. Wight, 517 Security Building, St. Louis, Mo.

Metropolitan Protective Devices.

The accompanying illustrations show a number of protective devices constructed under the Murray patents and manufactured by the Metropolitan Engineering Company, 1240-1250 Atlantic Avenue, Brooklyn, N. Y. There has been a demand for a complete line of devices which would insure electric circuits from unwarranted overloading, from tampering of any sort, and eliminating that bugbear of the central-station man, theft of current.

It is necessary, in order to make such a line of devices popular, that they can be attached with reasonable speed without the use of tools and other complications, and when once put in place will be proof against tampering without indicating that they have been disturbed.

FIG. 1.—METROPOLITAN HOOK-TYPE SEAL.

Fig. 1 shows one of the Metropolitan protective devices, which consists of a hook-type seal with a metal body and porcelain breaking button. The illustration shows very clearly the function of this device. The assembling is decidedly simple, the porcelain breaking button being inserted into the slot in the capsule, and the enlarged ends of the wire seal being inserted into the respective orifices in the porcelain button.

FIG. 2.—ALTERNATING-CURRENT METER WITH METROPOLITAN CUT-OUT.

Fig. 2 shows an alternating-current meter fitted with a Metropolitan cut-out with the fuses and terminal protector in position and sealed. In this case the hook-type seal is used in connection with a pair of links. The metal sleeve fits snugly up against the porcelain cut-out, and the fuses and terminal protector are securely locked in place by a link which is made secure against tampering by the book-type seal.

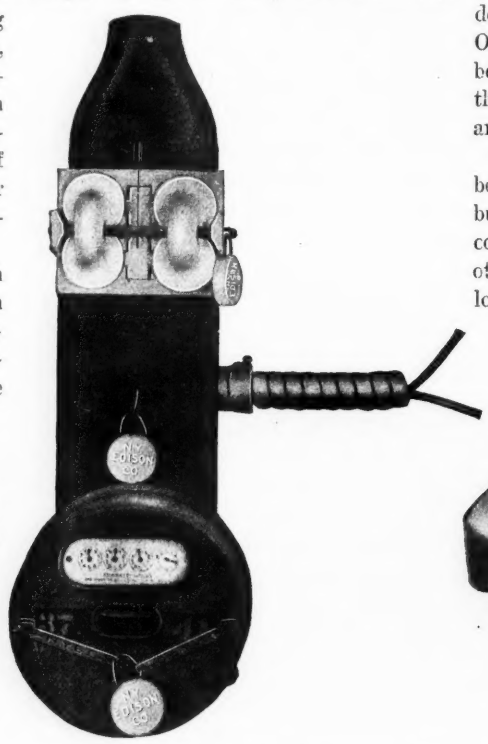


FIG. 3.—A.-C. METER WITH CUT-OUT AND METER-TESTING DEVICE.

Fig. 3 shows an alternating-current meter fitted with a Metropolitan cut-out showing the cover plates, fuses and terminal protector in position and sealed.

Fig. 4 shows a Metropolitan two-wire, single-branch, sealable plug cut-out with enclosed fuses, cover plate and seal in position.

These porcelain protective devices are made up in an innumerable variety of styles, making them applicable to every character of circuit connection.

These devices were exhibited at the recent convention of the National Electric Light Association, at Atlantic City, N. J., and attracted a good deal of interested attention from central-station men from all parts of the country.

FIG. 4.—TWO-WIRE, SINGLE-BRANCH, SEALABLE PLUG CUT-OUT.

The Electric-Lighting Scheme for the New York Electrical Show.

The third annual New York electrical show will be held in Madison Square Garden, New York city, from October 11 to October 21. This not only promises to be a financial success, but it is expected that it will be completely so from an artistic and decorative standpoint.

The entire dome of the Garden will be enclosed by a canopy made up of bunting in gold and white, completely covering the iron rafters, trusses and other constructive material. Directly below this clothwork there will be suspended six large art-glass chandeliers, each measuring about ten feet in diameter and carrying about 200 forty-watt tungsten lamps. Around these chandeliers there will be suspended an ellipse measuring about 80 feet by 200 feet, with twenty-eight bell-shaped fixtures, each carrying ninety twenty-five-watt and forty-watt tungsten lamps. In addition to these, there will be glass globes suspended on artistic scroll brackets from twenty-eight columns. The globes will be of stained glass, each carrying about twenty-five lights.

The scheme for building decoration and booth lighting will be carried out on the same scale. The entire contract for the execution of this work has been awarded to M. A. Singer, of New York, who is responsible for the decorative scheme.

Electrical Vehicle Company's Affairs.

The receivers of the Electric Vehicle Company, automobile manufacturer, of Hartford, Conn., on June 3 obtained from Judge Cross, of the United States Circuit Court, an order to show cause why an offer of a reorganization committee to take over the entire assets except the cash in the hands of the receivers, should not be accepted.

Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JUNE 5.—A tramway line has been opened for service between two of the suburban localities near Lyons. It runs on the monophase system and has been installed by the French Westinghouse Company. The line is about fourteen miles long. A high-tension current of 6,600 volts is furnished from a neighboring electric plant, and this is reduced to 600 volts for operating the tramway system. At present there are fifteen motor cars running on the line. Each car is fitted with two motors.

New sections of tramway are to be laid in the town of Budweis, Austria, and the government lately granted the concession for these lines to the International Electric Company, of Vienna. Three different sections are to be constructed in the first place.

An Austrian project of considerable scope relates to erecting several hydraulic stations of some size, in order to secure current for electric railroads in different parts of the country. For the Arlberg railroad there are to be used two turbine plants. One of these is located on the Selzrainer stream and is to give 12,000 horsepower. A second plant will be situated on the Loperbach, near Waidring, and is designed for 4,000 horsepower. Another new station is the Berg Isel turbine plant, and it will probably give 14,000 horsepower. At the start, it will give 3,000 horsepower or more for electric railroad work.

At the recent exposition of the Société de Physique, held at Paris, there was shown an apparatus, devised by M. Abraham and constructed at the Carpentier establishment, which gives a hysteresis diagram of transformers and other apparatus by direct projection on a screen. The curves are clearly observed in this way, and the instrument will be useful in various electrical work.

Among the new enterprises in Italy it may be noted that the Ligurian Company is to furnish electric-lighting mains in the towns of Cassano, Montella and Bagnoli. In the district of Florence, the concession has been granted for the electric lighting of the commune of Scarperia. The Italo-Swiss Company has secured the rights for light and power in the towns of Catenano, Portico, Resali and others.

A syndicate has been formed for an electrical enterprise in the region of Cartagena, Spain, including the mining district, relating to a light and power supply. The syndicate includes the local Carthagena Electric Union and also several Madrid and Bilbao electrical firms. A. DE C.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, JUNE 12.—An aerial electric tramway connecting the Big Thing Mine with the Yukon & White Pass Railroad, will be built this summer in the Windy Arm district of Yukon, at a cost of $80,000. Col. J. H. Conrad, C. E., of Vancouver, B. C., is the engineer in charge.

At Regina, Sask., the ratepayers have voted in favor of a number of by-laws for public improvements. Among the items is $78,000 for an electric-lighting plant. Inquiries should be addressed to the mayor.

With headquarters at Dawson City, Yukon, the Northern Light, Power and Coal Company has been incorporated, with a capital of $3,000,000. Bonds of the company were placed on sale in London, England, on June 11, and construction in connection with the development of power will commence this summer.

The Northwestern Battery Company, with a capital of $200,000, and headquarters at Winnipeg, Man., has been incorporated. Thomas B. Campbell, G. W. K. Watson and A. K. Dysart are the incorporators.

Robert Hamilton has been appointed Dominion inspector of electricity and gas for the Winnipeg district, with headquarters at Winnipeg, Man. This is a new office recently inaugurated by the Dominion government.

A syndicate of French capitalists state that as soon as the papers are signed they are prepared to commence the construction of radial lines from Edmonton, Alta., and will spend $500,000 this summer and approximately $2,500,000 during 1910 and 1911. It is expected all the necessary documents will be signed and in the hands of the representatives of the syndicate before the end of the month. R. F. R.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, JUNE 12.—Options are being taken on water powers about the city of Ottawa for the projected Morrisburg & Ottawa Railway. It is proposed to conduct the electric energy to Ottawa, and from this point it will operate the cars to and from Morrisburg. Light and power will also be furnished to the villages along the route.

The contract for the building of the electric road between Cobalt and Haileybury has been let to the Nova Scotia Construction Company, of Sydney, N. S., for the sum of $125,000, work to commence at once from the Cobalt end. The contract calls for the completion of the grading, ties and rails to be laid by September 1, next. The final arrangements for power to operate cars have not yet been decided upon, but one of the various companies, constructing plants on the Montreal River, will supply it.

The Minister of Justice at Ottawa has been petitioned to disallow the legislation, passed at the last session of the Ontario Legislature, governing the building of the hydroelectric transmission line, on the ground that it interferes with Dominion legislation. It is proposed to run the line along the public highway. Two legs of the towers carrying the cable are to be placed upon the highway and two legs on private or farm lands. There is no fence protection, and it is claimed that the line will be a very dangerous one, and liable to result in death to man and beast before it was operated very long. A. V. W.

IMPORTANT DEVELOPMENT.

(Special Correspondence.)

BUTTE ELECTRIC AND POWER—The Butte Electric and Power Company, of Butte, Mont., of which C. W. Wetmore, president of the North American Company, is president, has acquired half of the $2,500,000 capital stock of the Great Falls Water Power and Townsite Company, in which John D. Ryan and Thomas F. Cole are heavily interested. The Great Falls Company has already installed a hydroelectric plant of 8,360 horsepower, and is building a second plant of 36,000 horsepower, which will furnish power to the mines and smelters of the Amalgamated Copper Company. The Butte Electric Company has just sold to Lee, Higginson & Company an issue of $1,650,000 first-mortgage five-per-cent bonds, dated June 1, 1901, the proceeds of which are to be used to pay for this fifty per cent of Great Falls Water Power Company stock and for the balance of the Great Falls Electric Properties stock, which Butte Electric has purchased, giving it control of the electric railway and lighting systems of the city of Great Falls.

LIGHTING AND POWER.

(Special Correspondence.)

PORTALES, N. M.—This city has voted $75,000 in bonds for electric lighting and water plants.

AUBURN, CAL.—Wm. Mayer is planning to install an electric lighting and power plant at this place.

EL PASO, TEX.—The International Electric Supply Company has been incorporated with a capital stock of $25,000.

JEFFERSON, OKLA.—The Jefferson Power and Improvement Company has been incorporated with a capital stock of $100,000.

BRISTOL, TENN.—The Bristol Gas and Electric Company will install a steam turbine, with capacity of 1,500 horsepower and gasholder.

BELLE PLAINE, MINN.—The Borough Council has granted a franchise to Messrs. Arndt & Rockwater, of St. Paul, to operate an electric plant. C.

COPPER CREEK, ARIZ.—The Copper Queen Mining Company is preparing to double the capacity of its electric plant at its mines near this place.

TAFT, TEX.—Joseph F. Green, manager and part owner, is in charge of the Chas. P. Taft electric-light-plant proposition and will buy the necessary machinery.

HEFLIN, ALA.—J. B. McCrary & Company, Empire Building, Atlanta, Ga., are now preparing plans for the proposed waterworks and electric-light system at Heflin.

SAN FRANCISCO, CAL.—The Win Power Company has been incorporated here with a capital stock of $499,800 by J. M. Ager, Ferdinand Butterfield and Mr. Lotspeich.

GUAYMAS, STATE OF SONORA, MEXICO—An electric-railway system connecting this city with the outlying suburban villages of Aurora, Empalme and San Jose de Guaymas, is to be constructed by a syndicate of Americans, of which Epes Ran-

dolph of Tucson, Ariz., is at the head. Mr. Randolph is also at the head of the Cananea, Yaqui River & Pacific Railroad in Mexico. D.

HILLSBORO, ORE.—The Hillsboro Water, Light and Power Company has been incorporated here, with a capital stock of $40,000, by A. J. Stephenson, Charles F. Lyle and W. G. Hare.

WINNIPEG, MAN.—The Great Falls Power Company is considering the construction of a line from Emerson, Man., to Grand Forks, N. D., to supply that city electric power. C.

WAYCROSS, GA.—On June 19 the voters of this town will hold an election on a proposition to issue $36,000 for the purpose of installing a municipal lighting plant for the use of the town. L.

ASHLAND, WIS.—The Ashland Light, Power and Street Railway Company has taken possession of the White River power plant, for which it paid $158,500, and is planning extensions. C.

CALVERT, TEX.—The Calvert Water, Ice and Electric Light Company is to make improvements to its plant, expending $40,000. G. W. Sonnerfield, of Dallas, Tex., has the contract to erect the new building.

SAN FRANCISCO, CAL.—The Fresno Power Company has been incorporated here, with a capital stock of $1,000,000, by G. A. Night, J. M. Ough, H. M. Wooley, C. J. Heggerty and W. M. Madden.

BRAZIL, IND.—The Brinkerhoff Piano Company will, it is stated, soon ask for bids for the installation of machinery and electric-light and power equipment in a large factory building to be erected in this city. S.

LOS ANGELES, CAL.—The Janss Investment Company, which has been chiefly in the waterworks business, now plans to furnish electric current for lighting purposes, supplying a limited section of this city.

EUREKA, CAL.—The Snow Mountain Power Company is preparing to increase the capacity of its plant. Another dam will be built and another 5,000-horsepower dynamo will be installed at the plant on Eel River.

WAYCROSS, GA.—The city's bond election to be held June 19 to vote on municipal ownership of electric-lighting plant will also decide as to the issuance of $36,000 of bonds for the establishment and operation of the plant.

KERNERSVILLE, N. C.—The Kernersville Light and Power Company is being organized with $25,000 capital stock, and within four months power will be ready for lighting the town and supplying power demands to manufacturers. L.

COLUMBIA, S. C.—Plans are being formulated for the print cloth mill to be erected at Greers. They call for a structure of four stories, about 135 feet square. Electricity will be used and the equipment will consist of 10,000 spindles and 300 looms.

GREENWOOD, IND.—The right of the Town Board to grant a franchise for fifty years to an electric-light company has been upheld by the Supreme Court, although the company could not make contracts for service for a longer period than twenty-five years. S.

HERMISTON, ORE.—The Rose City Electric Construction Company, of Portland, Ore., has applied for a twenty-year franchise for an electric lighting and power plant in this city, with a stipulation that the company shall put in a plant to cost $15,000.

CHARLOTTE, N. C.—Work is progressing rapidly upon the new 30,000-spindle Waverly Cotton Mill, at Laurinburg. The promoters have decided to operate the new plant by electricity and an electric power plant, eighty-five by eighty feet, is being erected.

HURON, S. D.—C. I. Bowe, manager of the Huron Electric Company, has sold the plant to Coler Campbell, by which it passes to the control of the Huron Gas Company. A twenty years' franchise has been granted Mr. Campbell by the City Council.

FRANKFORT, IND.—The Indiana Lighting Company has decided to build and equip a large plant here, and will furnish light to Lebanon, Thorntown, Dayton, Mulberry and other towns, in addition to this city. Samuel Murdock, of Lafayette, is general manager. S.

JERSEY CITY, N. J.—The Warren County Power Company has been incorporated to generate electricity for light, heat and power, with a capital of $100,000. The incorporators are G. B. Cornell, Montclair, N. J.; J. G. Burt and J. A. McNelus, Brooklyn, N. Y.

CENTRALIA, WASH.—The North Coast Railroad Company has filed notice of the appropriation of water from the headwaters of the Cowlitz River. The water is to be carried a distance of six-and-a-quarter miles to the site of a power plant which the company will build on Lake Frederick, and will distribute current in Lewis, Pierce, Kittitas, Yakima and King counties.

PAWLING, N. Y.—The Pawling Electric Light, Heat and Power Company has been incorporated for the development of electric light, heat and power; capital, $20,000. Incorporators: George W. Chase, Frederick L. Gamage and Henry A. Holmes, Pawling, N. Y.

PUEBLA, MEXICO—The Compania Hidroelectrico de San Agustin and the Compania de Tranvias y Fuerza Motriz, which for a long time have been sharp competitors, have combined and made an agreement concerning the furnishing of electric light and power in this city. D.

BOSTON, MASS.—The Boston & Northern and Old Colony street-railway companies have petitioned the Massachusetts Railroad Commission for approval of an issue of $536,000 and $275,000 additional bonds, respectively. Proceeds are to be applied to improvements on property.

WINSTON-SALEM, N. C.—The Kernersville Light and Power Company is about to be organized with a capitalization of $25,000 authorized, and within four months it is expected to be ready to furnish electric light and power to commercial and private houses in the town of Kernersville.

FITZGERALD, GA.—The Fitzgerald and Ocilla Electric Railway and Power Company, Fitzgerald, Ga., has filed a mortgage to secure $250,000 of five per cent bonds, to cover the building of its proposed line between Fitzgerald and Ocilla, Ga. Construction of the road, it is expected, will begin soon.

BALTIMORE, MD.—The Consolidated Gas, Electric Light and Power Company has submitted a proposal to enter into a profit-sharing contract with the city of Baltimore reducing the cost of gas and power therein about one-half, provided assurance is given of freedom from harassing legislation in future.

VIRGINIA, MINN.—The Virginia Electric Power and Water Company has been incorporated by W. K. McLennan, Arthur H. Brown, William Elder, Arthur Howell and M. E. Riley, all of Duluth, Minn., with a capital stock of $200,000. The construction of an electric generating plant will be started at once. C.

RIPLEY, TENN.—Application for charter of incorporation has been filed in the register's office of Louderdale County by the Ripley Light, Water and Ice Company, with a capital stock of $15,000. The incorporators are Dr. J. W. Sanford, H. D. Folts, C. R. Barbee, W. G. L. Rice, E. A. Henry, J. W. Kirkpatrick, Miss Susie Anthony.

LITTLE ROCK, ARK.—A permit for the erection of a power plant at the Union Station has been issued by the Department of Public Works. The permit covers only the building, which is to cost $14,000. It was taken out by the Westinghouse-Church-Kerr Company. The power plant will cost $60,000. It will light and heat the depot.

LEOMINSTER, MASS.—On petition of selectmen of Leominster for a reduction in price of electricity, the gas commission recommends that the net price charged by the Leominster Light and Power Company shall be sixteen cents per kilowatt-hour. The present maximum net price is eighteen cents. Prices are also fixed for street lights.

SAN FRANCISCO, CAL.—F. W. Dohrmann, of this city, who is interested in three electric power plants near Chihuahua, Mex., was in San Francisco a few days ago on his way to New York. He reports that the capacity of the three plants, which is now 2,000 kilowatts, will be doubled. The details of the changes to be made will be worked out while Mr. Dohrmann is in New York.

GENEVA, ALA.—The Geneva Power Manufacturing Company has been incorporated with capital stock of $500,000 by D. O. Vaughan, J. R. Clark, D. G. McInnis, D. H. Morris and A. M. McKinnon. It is proposed to build a hydroelectric plant on Double Bridge Creek, six miles north of Geneva, and will transmit 5,000 horsepower by electricity to Geneva, Enterprise, Hartford, Coffey Springs, Samson and other towns.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas and Electric Company proposes to expend $610,000 in improvements to the electric and gas system. The betterments will include installation of 3,000-horsepower generator and $20,000 switchboard in power house, extension of electric-light wires, laying of forty miles of additional gas mains, making total of 109 miles, etc. A. H. Huey, Chicago, Ill., is vice-president of the company.

POTTSVILLE, PA.—The Philadelphia capitalists owning the Harwood Power Company, that is erecting a mammoth power plant at Harwood, near Hazleton, have announced their intention of forming companies in Black Creek, Foster, Sugarloaf, Nescopeck and Butler townships, all within a radius of 12 miles of Hazleton, for electric lighting and the furnishing of current. These companies will get their power from the Harwood plant.

ELECTRIC RAILWAYS.

(Special Correspondence.)

TWIN FALLS, IDAHO—George D. Aiken has been granted a franchise for an electric railway in this city.

ROCKWELL CITY, IOWA—It is proposed to electrify the Newton & Northwestern line to Fort Dodge Junction. C.

ANOKA, MINN.—Nearly all the right-of-way for the Anoka-Minneapolis suburban electric railway has been signed up. C.

STERLING, ILL.—The contract has been let for building an electric railway from Sterling to Rock Island, a distance of seventy miles.

MARSHFIELD, ORE.—J. F. C. Clark and J. H. Somers have been granted a franchise for an electric railway between Marshfield and Coquille.

PORTLAND, ORE.—The Portland, Baker City & Butte Railway Company has commenced the survey of its proposed line between Portland and Deschutes.

NEW ORLEANS, LA.—The New Orleans Railway and Lighting Company contemplates building an extension of the Dauphine line. Hugh McCloskey is the president.

HELENA, MONT.—It is stated that J. G. White & Company, of New York, have underwritten the $2,500,000 bond issue of the Helena & Butte Electric Railway Company. C.

ELIZABETH, N. J.—Construction of the electric line from Elizabeth to Suffern, N. Y., is being rushed. The road is being built by the North Jersey Construction Company.

WALLA WALLA, WASH.—The Washington Traction Company has been incorporated here, with a capital stock of $3,500,000, by G. Hunt, B. C. Holt, J. B. Catron and J. L. Mohundro.

WATERTOWN, N. Y.—Governor Hughes signed the bill permitting the construction of a trolley road between this city and Carthage by extending the franchise secured some years ago.

HAVERHILL, MASS.—The New Hampshire Electric Railways will assume control of and reconstruct the Haverhill, Merrimac & Amesbury, which since 1892 has been under control of E. P. Shaw.

SPARTA, WIS.—The contract for grading the first five miles of the Sparta-Melrose electric railroad out of Sparta has been let to G. W. Orton and W. G. Horn of New Lisbon. Work has been started. C.

INDIANAPOLIS, IND.—The Indiana Union Traction Company has added another freight train in order to haul the freight offered between this city and Ft. Wayne and points beyond in Indiana and Ohio. S.

MEDFORD, ORE.—H. H. Harris, of the Butte Falls Lumber Company, is now in the East for the purpose of ordering materials for the company's proposed electric railway line between Medford and Butte Falls.

INDIANAPOLIS, IND.—A contract has been let for elevating the Union tracks on East Washington Street, which will relieve the street and interurban roads of a dangerous crossing. The contract price is $153,000. S.

DAVENPORT, IOWA—Directors of the Tri-City and Northwestern Interurban Railway Company contemplate building another electric line between Rapids City, Port Byron, Cordova and Albany. Surveys are now being made.

CANANDAIGUA, N. Y.—The Cayuga Lake Traction Company will build a modern power plant at Cayuga Lake Park, to be utilized in supplying the line with additional power when necessary. The road will make other improvements at the lake.

SIDNEY, OHIO—A new line is projected between Sidney and Bellefontaine, and as prominent citizens of DeGraff, Quincy, Pemberton and Sidney have given their hearty support, contributing rights-of-way and money, work is likely to be started at once.

GRAND RAPIDS, WIS.—The Interurban Street Railway Company has let the contract for the construction of the road to Nekoosa to the Knox Construction Company of Chicago. Work will be commenced as soon as all franchises are obtained. C.

BUKWANA, S. D.—Articles of incorporation have been filed at Pierre for the South Dakota Interurban Railway Company, with headquarters at Centerville and a capital of $1,000,000. The purpose of the company is announced to be to construct a line of railway from Sioux City to Bijou Hills in Brule County. The proposed line is to be 160 miles in length.

MARYSVILLE, OHIO—The Columbus, Plain City and Urbana Traction Company, of Columbus, has been incorporated with a capital stock of $10,000 by Randolph W. Walton, Frank E. Ruth, Herbert M Myers, Charles A. Heath and W. L. McVey. The company is authorized to construct and operate an electric line from Columbus to Plain City and Urbana.

BENTON HARBOR, MICH.—Work has been started on a new interurban line which, when completed, will connect Benton Harbor and Hartford, Mich. The new line is to be built by eastern capital now interested in the Benton Harbor & St. Joseph Railway.

SALEM, N. Y.—The Rutland Railway, Light and Power Company is negotiating with the Delaware and Hudson Company with a view to electrify the lines between Castleton and Eagle Bridge and Fair Haven and Whitehall and operate them in connection with the present system.

JANESVILLE, WIS.—Emil G. Schmidt, western representative and general manager of the Clark syndicate, which is to take over the Rockford & Interurban Company properties on July 1, has announced that about a quarter of a million dollars will at once be spent on improvements.

GOLDFIELD, NEV.—The Hawthorne & Bodie Railway Company has been incorporated here, with a capital stock of $200,000, by Alonzo Tripp, George W. Thatcher and A. Nye to build an electric or steam line from Goldfield to the new camp of Lucky Boy, a distance of sixteen miles.

SAN DIEGO, CAL.—John D. Spreckels, as president of the San Diego and Arizona Railway, has signed a contract with Robert Sherer & Co., of Los Angeles, for grading the first section of the road, which is the stretch from San Diego to the Mexican boundary line, a distance of fifteen miles.

ST. JOSEPH, MO.—The automatic street indicator to be used on street cars, which was invented by G. R. Livergood and B. C. Donnelly, and which is backed by the Western Specialty Company, has been subjected to an exhaustive test on the Frederick Avenue cars. The results were favorable.

WHITE PLAINS, N. Y.—By a decision of Supreme Court Justice Arthur S. Tompkins, at White Plains, a motion to set aside the dissolution proceedings of the Westchester Electric Railway Company, now in the hands of a receiver, on the ground that the proceedings were illegal, is denied

KNIGHTSTOWN, IND.—A traction line is being promoted to run from this city to Shirley—a distance of twenty-three miles. The promoters say the line will pierce a community of 600 people to the mile, and with good traction line connection at each end will make the line a profitable undertaking. S.

BRUNSWICK, GA.—The City and Suburban Railway Company, of Brunswick, Ga., has been granted a charter by Secretary of State Philip Cook. The company proposes to construct an electric trolley line approximately four miles long, running from Brunswick out into the country. Its capital stock is $50,000.

HARTFORD, CONN.—The New York, New Haven & Hartford Railroad Company has begun the electric transportation of freight from Stafford Springs to East Hartford. Between Vernon and East Hartford the steam tracks of the Highland Division, which are equipped with the overhead trolley, are used.

FRANKFORT, IND.—The officials of the Frankfort, Delphi & Northern Traction Company announce that work on the line will begin at Pyrmont, a halfway point, in a short time. This line will run from Frankfort to Monticello, at which point power will be procured from the Tippecanoe Hydraulic Electric Company. S.

SCOTTSBURG, IND.—Arrangements are being made to hold a subsidy election in this county to vote a two per cent tax in aid of the construction of a traction line from Aurora to this city by the Cincinnati and Louisville Traction Company. If this road is built, Cincinnati, Louisville and Indianapolis will be connected by trolley. S.

HINTON, W. VA.—The Hinton Street Car & Transportation Company, of Hinton, W. Va., has been chartered to build a line from Hinton via Union, Avis and Red Sulphur Springs to connect with the Norfolk & Western Railway and the Virginian Railway at the mouth of East River, in Mercer County, West Virginia; capital, $50,000.

WAYNESBURG, PA.—At a conference here of the promoters of several trolley lines radiating from Waynesburg it was decided to proceed immediately with the construction of a line from Waynesburg to Claysville by way of Prosperity, with a spur from the latter point to Washington. The surveys have been completed and the rights-of-way secured.

PORTLAND, ORE.—At the annual meeting of the Wasco County Electric and Water Power Company at Condon the trust deed for the $15,000,000 bond issue, as approved by the Carnegie Trust Company, of New York, was approved by the directors and stockholders. George S. Carpenter was elected president and C. W. Lord, secretary of the company.

ASHLAND, ORE.—Through the reorganization of the Central Railway of Oregon into the Central Railroad of Oregon, the group of Boston and New Haven capitalists, who own this line, have placed themselves in a position where they are able at once to begin the financing of an extension through the Blue Mountain

country of Union and Umatilla counties. Articles of incorporation for the new company have been filed at Salem by Chester V. Dolph, the attorney in fact. The company is reorganized with a capital stock of $2,000,000 under the laws of Maine.

FREDERICK, MD.—The Washington, Frederick & Gettysburg Railway Company, of Frederick, Md., has been reorganized. The road is now operating about fifteen miles of line from Frederick to Thurmont, Md., with steam locomotives. It is understood that the new management contemplates rehabilitating the property, and that electric cars will be adopted.

NEWBERN, N. C.—A franchise to operate a local street-railway system has been granted to R. P. Foster and R. A. Nunn, for a period of thirty years, work to begin within one year, and two miles of track are to be in operation six months after beginning of work, company being chartered as Newbern Power Company, with an authorized capital of $500,000. L.

ALBANY, N. Y.—The Public Service Commission, Second District, has authorized the Babylon Railroad Company to extend its line from Babylon to Amityville. It is also authorized to increase its capital stock from $25,000 to $75,000 and to issue common capital stock to the amount of $50,000, to be used in construction of new ferry line connections at Babylon.

HOUSTON, TEX.—At a meeting of stockholders and directors of the Marshall & East Texas Railroad, held recently at Marshall, plans were formulated for building the line from Marshall to Newton, Tex., a distance of about 125 miles. The capital stock of the company has been increased from $75,000 to $200,000, all the additional amount being subscribed, it is stated.

CONDON, ORE.—The Inland Oregon Electric Railway Company is being organized here by M. W. Gill, H. J. Martin and C. D. Charles, who are also interested in the Butte-Portland line. The new company plans building an electric railway from Condon to Canyon City and a branch line from Fossil to a connection with the main line of the Butte-Portland system.

AKRON, OHIO—Plans are being made by the N. O. T. & L. Company to complete the Turkeyfoot Lake line and to extend it through to Massillon. The line when built will develop the chain of lakes about Turkeyfoot into an ideal summer resort for the entire northern Ohio. The N. O. T. Company has already spent $50,000 to get the right-of-way and is grading for the line.

SACRAMENTO, CAL.—The California Traction Company has begun suit against the Board of Supervisors of this county to test the statute of 1908 which provides for the sale of electric-railway franchises and taxes electric lines two per cent of the gross receipts for the use of the franchise. This is held to be an unjust discrimination against electric as compared with steam lines.

LOS ANGELES, CAL.—The Pacific Electric Railway will construct at once a line between Huntington Beach and Delhi, a distance of ten miles. The Pacific Electric now has a line in operation between Santa Ana and Delhi, over which material and machinery for the Southern California Sugar Company's new sugar factory have been transported. Passenger cars are now being operated.

LITTLE ROCK, ARK.—Articles of incorporation showing the formation of the Doniphan, Kensett and Searcy Railway Company, a concern recently incorporated for the purpose of purchasing the line of railroad now operating from Doniphan to Searcy, via Kensett, have been filed with the secretary of state. The company is incorporated with a capital stock of $100,000, of which $12,000 has been subscribed, or $2,000 per mile of the railroad.

INDIANAPOLIS, IND.—There is considerable rivalry among the interurban roads centering in this city in the matter of furnishing frequent high-speed limited car service. The Ft. Wayne and Wabash Valley Traction Company is running twelve high-speed limited cars between Ft. Wayne and Indianapolis, and the Indianapolis, Columbus and Southern Traction Company is running six high-speed cars each way each day between Indianapolis and Louisville. S.

RIVERSIDE, N. J.—Foreclosure on the Camden & Trenton Railway Company is expected under the agreement in the general mortgage bondholders' plan of reorganization within four or five weeks. The new corporation, which is to be known as the Riverside Traction Company, will spend $300,000 in the betterment of tracks and equipment with a new plant to be located at East Burlington. The two electric-light plants at Riverside and Bordentown which supply power will be turned over to holders of bonds.

COLUMBUS, OHIO—The Ohio Railroad Commission has rescinded its order requiring electric lines to prepare a new schedule showing distance and rates to all stops, as a result of the conference of the Commission and representatives of the companies. The latter were able to demonstrate to the Commission's satisfaction that the order would work a hardship on them and offered to readjust rates so that not more than five cents would be charged for new zones of two-and-one-half miles, which will be established by the various lines.

ROCK ISLAND, ILL.—Work on the Davenport and Manchester line is to be pushed. The proposed line is to be 110 miles long, and is of particular interest to the Tri-Cities, as it will intersect the Chicago & Great Western, Chicago & Northwestern and the Illinois Central railways, thus giving direct connection with the three cities. The line will pass through Manchester, Monticello, Stanwood, Olin and Bennet and numerous other important cities in Iowa.

SAN JOSE, CAL.—Jere T. Burke, representing the E. H. Harriman interests, was the successful bidder for the fifty-year electric-railway franchise over the streets now included in the system of the San Jose Traction Company in this city. The old franchises are about to expire and the competition between the Harriman and the San Jose Traction interests ran the price of the franchise up to $11,000, at which figure Mr. Burke was awarded the franchise.

TOLLESTON, IND.—The South Shore Traction Company was denied an injunction by Judge Tuthill against the Gary Traction Company wherein it was sought to enjoin the Gary company from building a line into Tolleston. The South Shore people say that two companies operating in Tolleston would not be profitable, and also allege that the town board agreed not to grant a franchise to any other company for five years at the time they accepted their franchise. S.

LAKE CITY, IOWA—President Loring of the Fort Dodge, Des Moines and Southern Railway Company has lately been in Rockwell City, a town just north of here, and left with the Business Men's Association a proposition looking to the electrifying of the company's line between Rockwell City and Fort Dodge Junction, a distance of twenty-five miles. They propose to complete the work, provided a guarantee of $20,000 be paid upon the completion of the road and the operation of cars.

GUTHRIE, OKLA.—A charter has been taken out by C. T. Edwards, who built the Dallas-Fort Worth electric railway, for the Shawnee Electric Railway Company. The company proposes to build a line from Shawnee to Muskogee, a distance of 120 miles, passing through the towns of Prague, Okmulgee and Holdenville, at a cost of $3,000,000. Also a line from Shawnee to Oklahoma City, forty miles, passing through the towns of Dale, McCloud, Harrah and Choctaw City, at a cost of $1,000,000.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

AMHERST, WIS.—The Amherst Telephone Company will extend its line to Stevens Point, where it will connect with the Bell system.

BALLARD, WASH.—The Pacific Telephone and Telegraph Company has bought a site for a central station shortly to be erected here.

FORSYTH, MONT.—The Smith River and Castner Coulee Telephone Company has been organized. It will connect with the Bell Telephone Company at Great Falls. C.

TACOMA, WASH.—The Telephone Supply Company of Tacoma has been incorporated here, with a capital stock of $100,000, by G. A. Hawley, P. L. Burns and others of Seattle.

GREAT FALLS, MONT.—A site has been selected for the exchange building of the Montana Independent Telephone Company, and work will shortly be started on the installation of the system. C.

ALAMEDA, CAL.—Manager Brownlee, of the local office of the Pacific Telephone and Telegraph Company, announces that improvements costing $200,000 are about to be made in the company's system here.

CHRISMAN, IND.—The Portage Home Telephone Company has increased its capital to $50,000. The company proposes to build additional lines, improve its exchange and add new equipments. J. J. Robinson, president. S.

BOSTON, MASS.—The Keystone Telephone Company has sold to Fisk & Robinson $1,000,000 of its $10,000,000 first-mortgage, 30-year, 5 per cent bonds. Of the total authorized, $5,312,000 were outstanding on June 30, 1908.

FOWLER, IND.—The Indiana Union Telephone and Telegraph Company has incorporated to construct and operate telephone lines in Benton, Warren, White, Jasper, Newton, Lake and Porter counties. The capital stock is $100,000. David P. Williams, C. L. McNaughton and F. A. De Peyster, directors. S.

NEW YORK, N. Y.—The New York American's free information bureau, started the last week of May, marks the development of the telephone idea and is worth mentioning. The bureau takes care of and answers any questions. A perfect telephone system has been arranged so that any call will be answered immediately. This means that the lawyer, merchant, doctor, clerk or banker can reach for his desk telephone at any moment during a baseball game and ascertain the score, or ask about some individual or a scientific question, and there is absolutely

no charge for answering these questions, no matter whether it requires one second or an hour's research. So far it has been a great success, both from the point of view of the American and the general public.

RUSHVILLE, IND.—The Lot Green Telephone Company has been chartered by the Secretary of State to build and equip a telephone system in Rush County, with home office in Rushville. Henry Schrader, chairman of the board of directors, announces that the company is in the market for material. S.

BRAZIL, IND.—The Citizens' Telephone Company, of this city, has taken over the local exchange and property of the Central Union Telephone Company, in this city, and county. The Central Union will maintain a toll station here, but there will be no connection made with the Citizens' plant. The local field has been abandoned by the Central Union so far as local service is concerned. S.

NASHVILLE, TENN.—The Cumberland Telephone Company has now passed the 200,000 mark in the number of its stations, the exact figure, on May 1, being 200,115, an increase of 12,856 stations since January 1. It has taken the Cumberland Telephone Company only a little more than five-and-one-half years to increase its stations from 100,000 to 200,000, a fact which speaks significantly of the great telephone development of the country.

INDIANAPOLIS, IND.—The Indiana Union Telephone Company has incorporated with a capital of $100,000. The declared object is to maintain and operate telephone plants in Benton, Warren, White, Jasper, Newton, Lake and Porter counties. The company is incorporated by employes of the Central Union Telephone Company, and this is taken to mean that the Central Union will take over and operate a number of independent companies in the counties named. S.

PHILADELPHIA, PA.—It is understood that the Keystone Telephone Company has sold $1,000,000 of its $10,000,000 first-mortgage, 30-year, 5 per cent bonds to Fisk & Robinson, of New York, to pay for improvements. Of the $10,000,000 authorized issue, $5,312,000 were outstanding June 30, 1908. It is rumored that the company, being provided with funds for improvements from the sale of bonds, will begin to pay the accumulated preferred dividends. There is $1,936,850 preferred stock outstanding.

INDIANAPOLIS, IND.—There is a divergence of opinion between the officials of the Central Union Telephone Company and the Long-Distance Independent Telephone Company, relative to the effect of the recent decision of Judge Tulor, of the Federal Court. The former declare that it clears the atmosphere and permits working agreements between the Bell and Independent companies, while the latter say it widens the field for independents and will occasion the Bell to abandon local fields for long-distance service and the field, once abandoned to the Independents, cannot be reclaimed. S.

PROSSER, WASH.—The Benton Independent Telephone Company has purchased the franchise and entire equipment of the Prosser Telephone Company. The Prosser company will maintain its office and long-distance connections till June 1, when its contract with the Pacific States Company passes to the new company. The contract has about five years yet to run. The Benton company has severed its connections with the Sunnyside Telephone Company and has made complete arrangements with the Yakima Valley Telephone Company to handle the long-distance business west of this point.

ELKHART, IND.—The Board of Public Works having refused to grant the Home Telephone Company an amended franchise permitting higher rates, has blocked the plan of consolidation of the company with the Central Union Telephone Company. It was agreed, in the event of securing a new franchise, the Central Union would abandon the local field to the Home Company in exchange for the toll line business originating on the Home Company's lines that could not be handled by the independent toll lines. Now that official action has blocked this deal, there will be a renewal of the battle for supremacy between the two companies. S.

CLEVELAND, O.—According to E. G. Tillotson, chairman of the board of directors of the United States Telephone Company, the war between the "Independents" and the "Bell" people over long-distance business is to be carried to the highest courts. At the present time the independents have won two cases in the state courts and lost one in the federal courts. The president of the Central Union and Cleveland Telephone Company has issued a statement in which it indirectly charges the independents with stock jobbing and stock watering, and declares the intention of the Bell interests to "harmonize all interests and bring about the best results to the public," and also to bring about a unification of the telephone business of the country with safety to the investor, to its own securities and to those of the independents. The independents issue a statement declaring that the issue with the Bell company is to be fought out in the state courts. Independent telephone companies are warned against making connection with Bell long-distance wires, the intimation being plainly given that suits to recover damages will follow. Attorneys for the independents are instructed to proceed vigorously with the fight and carry the litigation to the courts of last resort.

ELECTRICAL SECURITIES.

While trading was active last week, the bull campaign appeared to have lost a good deal of its impetus, and price movements were irregular, with some declines. Commission houses are complaining again of lack of public interest in the stock market.

Dividends have been declared upon the following electrical securities: Union Passenger Railway Company; the regular semi-annual dividend of $4.75 per share. West Philadelphia Passenger Company; the regular semi-annual dividend of five dollars per share. Both dividends are payable July 1 to stock of record June 15. The companies are subsidiaries of the Philadelphia Rapid Transit Company. Manila Electric Railway and Lighting Corporation; the regular quarterly dividend of one per cent on the common stock, payable July 1 to stock of record June 15. United Traction and Electric Company; the regular quarterly dividend of one-and-one-fourth per cent, payable July 1. United Gas Improvement Company; the regular quarterly dividend of two per cent, payable July 15 to stock of record June 30. Western Union Telegraph Company; the regular quarterly dividend of three-fourths of one per cent, payable July 15 to stock of record June 19. Union Traction Company; a semi-annual dividend of $1.50, payable July 1 to stock of record June 9.

ELECTRICAL SECURITIES FOR THE WEEK ENDED JUNE 14.

New York:	*Closing.*
Allis-Chalmers common	15¾
Allis-Chalmers preferred	52½
American Tel. and Tel. Company	142⅝
Brooklyn Rapid Transit	80¼
General Electric	163¾
Interborough-Metropolitan common	16⅝
Interborough-Metropolitan preferred	46⅛
Kings County Electric	125
Mackay Companies (Postal Telegraph and Cable) common	81
Mackay Companies (Postal Telegraph and Cable) preferred	73
Manhattan Elevated	143
Metropolitan Street Railway	25
New York and New Jersey Telephone	110
Western Union	75
Westinghouse Manufacturing Company	86⅞
Boston:	*Closing.*
Edison Electric Illuminating	248
Massachusetts Electric	67
New England Telephone	132
Western Telephone and Telegraph pref.	87
Philadelphia:	*Closing.*
Electric Company of America	12¼
Electric Storage Battery common	54
Electric Storage Battery preferred	54
Philadelphia Electric	11¾
Philadelphia Rapid Transit	28¼
United Gas Improvement	88¼
Chicago:	*Closing.*
Chicago Telephone	133¼
Commonwealth Edison	119¾
Metropolitan Elevated preferred	50
National Carbon common	93
National Carbon preferred	117

NEW INDUSTRIAL COMPANIES.

(Special Correspondence.)

CHICAGO, ILL.—The Indicator Electric Company has been incorporated to manufacture electrical appliances. The incorporators are M. R. Leahy, A. A. Radtke, E. Gorman, of Chicago, and the capital is $30,000.

WILMINGTON, DEL.—The Rae Electric Vehicle Company has been incorporated with a capital of $150,000. The incorporators are C. F. Clendennin and N. F. Griffin, New York city, and S. A. Love, Philadelphia, Pa.

CHICAGO, ILL.—The Continental Electric Company has been incorporated to do a general electrical engineering and contracting business. The capital is $12,000 and the incorporators are: Harry Bierm, E. E. Schmuck and Alje Bierm.

SPRINGFIELD, MASS.—The Hall Tide Power Company has been incorporated; object, to produce power by means of tides; capital, $500,000. President, Arthur Wooley, Chicopee; treasurer, John Hall, West Somerville; clerk, Charles J. Seaver, Chicopee.

ST. LOUIS, MO.—The Imperial Electric Clock Company has been incorporated with a paid-in capital stock of $60,000. The officers are: President, Frank Feraud; first vice-president, Dr. W. H. Grayson; second vice-president, Joseph Speis; secretary, Henry Connole; treasurer, W. O. Trott. These officers and Dr.

W. F. Grayson, A. Connole and F. A. Garesche, mayor of Madison, Ill. The company probably will erect a factory at Madison, to manufacture electric clocks, of which Frank Feraud is the inventor.

MENOMINEE, MICH.—The Tideman Hearophone Company has just been incorporated, with a capital stock of $30,000, to exploit an instrument to enable the deaf to hear, the invention of Henry Tideman, of the Menominee Electrical Works. C.

THE WENTWORTH-DEAN COMPANY has been incorporated at Lima, Ohio, with a capital stock of $10,000. The company will make and handle electrical goods. The officers of the new company are: President, E. A. Dean; vice-president, E. H. Wentworth; secretary-treasurer, Walter O. Dean.

CAMDEN, N. J.—The Automatic Electric Shoe Shining Company has been incorporated to deal in automatic shoe-shining machines, with a capital of $100,000. The incorporators are W. S. Righter, Lansdowne, Pa.; S. Printz, F. C. Baumiller, G. C. Worster, Philadelphia, Pa., and A. P. Willetts, Beach Haven.

HARTFORD, CONN.—The Brass Products Company, of Southington, Conn., has filed a certificate of incorporation with the state secretary. The company will manufacture and deal in all kinds of electric fixtures. The amount of the authorized capital stock is $50,000. The incorporators are William R. Miller, James H. Pratt, John Hemingway and E. G. Lewis.

PEORIA, ILL.—Articles of incorporation of the Union Electrical Company have been filed with the recorder. The incorporators are George H. Glass, George A. Vint and James W. Barrett, and the capital stock of the concern is $6,000—sixty shares at $100 each. The object of the company, as stated in the application for a certificate of incorporation from the Secretary of State, is for "the manufacture, vending and sale of any and all kinds of electrical tools, machinery and appliances now or that may hereafter be used in and about the use of electricity and the generation thereof. The primary object, however, is the manufacture of the cable stretcher patented by Mr. Glass. The enterprise is strictly a Pekin, Ill., venture.

NEW PUBLICATIONS.

NEW YORK PUBLIC SERVICE COMMISSION REPORT—The quarterly reports for the three months ending March 31, dealing with the Interborough Rapid Transit Company and the subsidiary companies of the Brooklyn Rapid Transit Company, have now been made public. The reports represent a compilation of assets and liabilities of non-operating (lessor) companies. Separate abstracts have already been printed showing the operations of the companies to which these properties were leased.

SOCIAL ENGINEERING—Mr. Vuibert, director of Vuibert and Nony, publishers, 63 Boulevard St. Germain, Paris, announces the translation of "Social Engineering," a volume of studies of American life and labor, by Dr. W. H. Tolman, director of the Museum of Safety and Sanitation. Andrew Carnegie has written the introduction and the translation is in the hands of Pierre Janelle. It is expected that the foreword of the French edition will be by Professor Levasseur, Administrateur College de France. The book was published in the United States by the McGraw Publishing Company, New York, in February of this year. A review will appear later.

BULLETIN OF THE BUREAU OF LABOR—The March, 1909, number (No. 81), which has just come to hand, is devoted principally to an analysis of wholesale prices of commodities for the years 1890 to 1908, with actual prices for 1908 and relative prices for the preceding years. This investigation shows that wholesale prices, considering the 258 commodities as a whole, receded from the high level of 1907, which was the year of highest prices of the nineteen-year period covered. The recession in 1908 carried prices back approximately to the level of 1906, but, with the exception of 1907 only, prices as shown by the 258 articles here considered are higher than in any other year during the nineteen-year period. The average for the year 1908 was 5.2 per cent below that for 1907; 0.2 per cent higher than that for 1906; 36.9 per cent higher than for 1897, the year of lowest prices during the nineteen-year period, and 22.8 per cent higher than the average for the ten years from 1890 to 1899. The decline from the prices shown by the October, 1907, data continued without interruption until August of 1908, with the exception of a slight advance in July. Prices were at their lowest point of the year during the month of August, when they were 1.1 per cent below the average for the year 1908 and 7.3 per cent below the average for October, 1907, the highest point of the nineteen years covered. The prices in December show an advance of 1.8 per cent over the prices in August, the month of lowest average prices during the year. Comparing 1908 with 1907, the groups showing the greatest decrease in prices were metals and implements, lumber and building materials, and cloths and clothing. Food, etc., was the only important group of commodities which showed an increase in price.

EDUCATIONAL NOTE.

PRINCETON UNIVERSITY, SCHOOL OF ELECTRICAL ENGINEERING—The catalogue of this school, bearing the date of June, 1909, has just been published. The Princeton electrical school provides a two-year graduate course leading to the degree of electrical engineer. Graduates of any accredited college are admitted without examination, provided they have taken the requisite courses in mathematics (including calculus and elementary differential equations), general and experimental physics, and general chemistry. Applicants who are not graduates of any institution may be admitted to the course upon passing satisfactory examinations in these subjects. Besides the laboratories of the school itself, the electrical engineering students are permitted to use the university power plant for experimental study. This plant includes six 250-horsepower boilers, for power and steam heating; two 200-kilowatt and one 100-kilowatt direct-connected, alternating-current generators and one 300-kilowatt alternating-current generator, direct-driven by a Curtis steam turbine; one motor-driven exciter and one steam turbine-driven exciter; the station switchboard and a special experimental switchboard.

OBITUARY.

JAMES A. RICHMOND, of New York city, who was prominent in New York traction affairs with Jacob Sharp a number of years ago, died unexpectedly in Paris, France, on June 7. He was born seventy years ago in Little Falls, N. Y. The body was sent to New York for burial. Mr. Richmond had lived at the Grand Hotel in Paris for many years. He had been ailing for several weeks. His death is believed to have been due to peritonitis, following an attack of appendicitis.

M. D. BARR died very suddenly from heart failure in Sandusky, Ohio, on May 29. Mr. Barr had been associated in the electrical industry for the past twenty-five years, beginning in Canada as M. D. Barr & Company, and about fifteen years ago joining the Stanley Electric Manufacturing Company, of Pittsfield, Mass., as manager of its New York office, and subsequently general sales manager. When the Stanley company was acquired by the General Electric Company, Mr. Barr was made vice-president, the other vice-presidents being the late Dr. F. A. C. Perrine and C. C. Chesney. Subsequent to this Dr. Perrine withdrew and Martin J. Insull became Mr. Barr's and Mr. Chesney's associate as a vice-president. In 1906, when the General Electric Company decided to discontinue the commercial department of the Stanley Electric Manufacturing Company, and the Pittsfield factory became the Pittsfield works of the General Electric Company, Mr. Barr and Mr. Insull withdrew, Mr. Barr engaging for a time in the exploitation of street-railway properties in New England. A year or more ago when the creditors of the Warren Electric Manufacturing Company, of Sandusky, Ohio, were looking about for someone to manage their property, Mr. Barr was selected for the place and made general manager of that company. When some months later it was finally determined that bankruptcy for this concern was inevitable, Mr. Barr was appointed first trustee for the bondholders, and in February, of this year, he was made special master of the property by the local Common Pleas Court. He has been engaged since that time in winding up its affairs. Mr. Barr had numerous friends in the electrical industry, especially in Toronto, New York, Pittsfield and Boston. His home was in Spencer, Mass., from which place was held his funeral, on June 2.

PERSONAL MENTION.

PROF. J. A. BROWN, of Dartmouth College, has accepted the chair of physics at the Protestant College of Beirut, Syria.

EMERSON McMILLIN, former president of the American Light and Traction Company, has completed a six weeks' tour of inspection of the company's properties.

DR. IRA REMSEN, president of the Johns Hopkins University, has been selected president of the Society for Chemical Industry for the meeting to be held next year in Glasgow.

R. T. GUNN, who has been general manager, has been elected vice-president of the Eastern Wisconsin Railway and Light Company, of Fond du Lac, Wis., to succeed N. C. Draper. C.

FRANZ J. DOMMERQUE, M. E., has been appointed general representative of the Stromberg-Carlson Telephone Manufacturing Company, with headquarters at that company's main offices in Rochester, N. Y.

VICE-ADMIRAL URIU, of Japan, and his party were the guests of Wallace Nesbitt, late justice of the Supreme Court of Canada, on a trip to Niagara Falls, down the gorge and through the power plant of the International Power Company, on June 7. On June 11 Vice-Admiral Uriu was the guest of Lindsay Russell and W. G. McAdoo, of the Hudson River Tunnel Company, at a luncheon in the Railroad Club, New York city. After the luncheon the admiral and his party were escorted through the new Hudson River Tunnel, which is to be opened to the public early in July.

PROPOSALS.

MARINE HOSPITAL, WASHINGTON, D. C.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., June 30, for the approach work at the Hygienic Laboratory of the Marine Hospital Service at Washington, D. C., in accordance with the drawing and specification, copies of which may be had at the Supervising Architect's office.

NAVY YARDS, NEW YORK, PHILADELPHIA AND BOSTON —The Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive sealed proposals until 11 o'clock a. m., July 10, for furnishing one 1,000-kilowatt and two 1,500-kilowatt turbo-alternators for the navy yards, New York, Philadelphia and Boston. Specifications can be obtained on application to the bureau or to the commandant of the navy yards named.

POST OFFICE AND COURT HOUSE, PADUCAH, KY.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 14, for the extension, remodeling, etc., of the United States Post Office and Court House at Paducah, Ky., in accordance with drawings and specification, copies of which may be had from the custodian at Paducah, Ky., or at the Supervising Architect's office.

NAVY YARD, PHILADELPHIA, PA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive sealed proposals, endorsed "Proposals for Electric Apparatus," until 11 o'clock a. m., July 10, instead of June 26, 1909, as formerly advertised, for motor-generator sets, exciters, switchboard, etc., at the navy yard, Philadelphia, Pa. Specifications can be obtained on application to the bureau or to the commandant of the navy yard named.

COURT HOUSE AND CUSTOM HOUSE, NEWBERN, N. C.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 15, for the extension, remodeling, etc., of the United States Post Office, Court House and Custom House building at Newbern, N. C., in accordance with drawing and specification, copies of which may be had at the office of the custodian at Newbern, N. C., or at the Supervising Architect's office.

POST OFFICE AND CUSTOM HOUSE, GULFPORT, MISS.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., June 21, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office and Custom House at Gulfport, Miss., in accordance with drawings and specification, copies of which may be had from the custodian of site at Gulfport, Miss., or at the Supervising Architect's office.

FORT DOUGLAS, UTAH—The office of the Chief Q. M., Denver, Colo., will receive sealed proposals, in triplicate, until 11 a. m., July 6, for furnishing electric current at Fort Douglas, Utah, for illuminating and small motor purposes. Distributing system will be ready for current about January 1, 1910. Information furnished on application to the office of the Chief Q. M., Denver, Colo., or to the post quartermaster. Envelopes containing proposals should be marked "Proposals for Electric Current," and addressed J. W. Pope, Chief Q. M.

INDUSTRIAL ITEMS.

THE NEW YORK INSULATED WIRE COMPANY, New York city, is distributing a series of advertising blotters. One of these has a calendar of the month on the back. This is a most useful innovation.

THE KEYSTONE LUBRICATING COMPANY, Philadelphia, Pa., announces that the Interborough Rapid Transit Company, of New York city, has adopted Keystone grease for all the escalators at its "L" stations.

THE CHICAGO FUSE WIRE AND MANUFACTURING COMPANY has issued a new standard price list of "Union" enclosed fuses and cut-outs. This list covers National Electrical Code devices and corresponds to the list used for some time by other leading fuse manufacturers.

THE H. W. JOHNS-MANVILLE COMPANY, New York city, has issued a new circular which expatiates in a convincing manner on the saving of money that is effected by the use of J-M conduit in place of the ordinary conduit. Everyone interested in underground conduit systems for steam, hot-water, refrigerating and oil pipes, etc., is invited to investigate the J-M conduit system.

THE DEL SALES COMPANY, Chicago, Ill., has issued a folder on the "Del" electric curling iron. This company is also distributing a leaflet warning the trade that all infringers of their patent No. 884,296 (granted April 7, 1908, to C. A. Pickards on Electric Curling Irons), whether they be manufacturers or simply sellers, will be proceeded against according to law. One suit in this connection has already been brought, and others are pending.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has brought out the June number of "Trumbull Cheer," which besides the usual miscellaneous light literature contains some interesting information on Type A switches, which are made in all styles for from fifteen to 5,000 amperes.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., is distributing a new folder on "Flexduct," the new flexible tubing with the soapstone interior finish. This company has also issued another folder with which is a halftone illustration of the Federal Building, Buffalo, N. Y., which was installed with National Metal Molding.

THE EWING-MERKLE ELECTRIC COMPANY, St. Louis, Mo., will within the next few days sell its stock and good will at either private or public sale. Ira E. Wight, 517 Security Building, St. Louis, Mo., is handling the sale. While he would prefer to sell it for cash it is stated that the right party can secure it for a small cash payment.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has received an order for a 1,500-kilowatt, 550-volt, direct-current generator, to be used in the machine-shop department of the Union Stock Yards of Armour and Company, of Chicago. A similar machine of 800 kilowatts at 575 volts was sold to Landers, Frary and Clark, of New Britain, Conn.

THE BOSTON INSULATED WIRE AND CABLE COMPANY, Boston, Mass., is erecting a new building in the Dorchester district. This is being erected by the Aberthaw Construction Company, also of Boston. On account of the location of the factory being on a soft marsh it was necessary to drive piles. These were capped with reinforced concrete footings and piers which support the first floor. This design saves the expense of all wall foundations.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., is distributing a suggestive booklet (Folder 4132, June, 1909), entitled "Westinghouse Electric Motors for the Office, Store and Shop." Among the applications of the electric motor described are the motor-driven vacuum cleaner, coffee grinder and meat chopper, sign flasher, adding machine, mailing machine, eraser for drafting rooms, air pump, buffing (polishing and grinding) machine, forge blower, box-covering machine, small lathes, graphophone, electric drills and other tools, envelope sealer, hacksaw, etc. Domestic applications are described in Folder 4149, which can be obtained on request.

THE DEARBORN DRUG AND CHEMICAL WORKS, Chicago, Ill., has issued a pamphlet, entitled "Lubrication Versus Friction." This contains a description of the various lubricants manufactured by the Dearborn Company, giving the gravity, flash point, burning point, viscosity and application, in each case. The greater part of the pamphlet is taken up with a study of lubricants in general, the art of lubrication, and the various methods for testing lubricants, with a description of the instruments employed. No user of lubricants should fail to obtain a copy of this useful publication, which contains a considerable amount of useful practical information in a most convenient, compact and accessible form.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has issued Bulletin 351 to supersede No. 321. This contains a complete illustrated description of Triumph induction motors, with special reference to the twenty-five-horsepower, three-phase type. Slip-ring attachments for variable-speed work and for extremely heavy starting duty, and back-gear attachment for very slow or special speeds, are described, the former, however, being only made to order. Vertical motors, which are built by the company for all standard sizes, are also mentioned. Illustrations are shown of induction motors driving a rubbing machine in a piano factory, and a band saw; also of a motor-generator set and a direct-connected motor-driven pump. Descriptions of special starting devices for induction motors complete the bulletin.

THE SPAULDING AND PAYOR COMPANY, 17 State Street, New York, N. Y., is the sole importer of "Plania" carbons, which are manufactured in Germany. The line includes enclosed carbons for all types of enclosed arcs, specially made to United States standards and operating with high efficiency and economy; special carbons made for all types of miniature arc lamps and high-tension arc lamps; enclosed carbons for arc headlights giving a clear, intense white light; "Schein" carbons for searchlights and motion-picture machines; "Effect" carbons for all types of alternating-current flaming-arc lamps, giving an intense steady yellow flame; "Effect carbons for all types of direct-current flaming-arc lamps, giving an intense steady yellow flame. The latter carbons are also made for red and white flames. Full information and prices may be secured by those interested upon request.

THE NATIONAL LAMP ASSOCIATION, through its engineering department, has just published bulletin No. 6E, devoted to tungsten sign lamps. These lamps are made to consume five watts at eight to twelve volts and are rated as having an efficiency of one-and-one-third watts per candle. They therefore replace

the four-candlepower carbon lamps that are in extensive use for this purpose. The bulletin gives many tables and curves, showing comparative economy of the tungsten and carbon lamps, as well as polar distribution curves, discussion of uses and operating methods for the tungstens. On alternating-current systems they are wired in multiple in the secondary circuit of a regular step-down or auto-transformer. On direct-current circuits they must be wired in series or in series parallel. Typical circuit diagrams are shown for each of these methods of installation.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has issued Bulletin 3908 (replacing No. 3903) on "Factory Sewing Machine Motors" for Singer Types 31-15 and 31-20 machines, for alternating and direct current. Motors for all types of family sewing machines are described in another bulletin, which will be sent on request. The Emerson company is also distributing a sheet price list of fifteen-inch Parker fans for single-phase current, and fifteen-inch Parker fans for direct current, which are designed as exhaust fans for moving-picture theaters and similar places. These fans are furnished without rheostats (which are not needed) and are practically noiseless in operation. The "Emerson Monthly" for June contains an article, "Profitable Methods in Selling Fan Motors," besides several trade items. The "Reference Supplement" to this contains a complete list of manufacturers and dealers selling complete motor-driven outfits, in all lines, equipped with Emerson motors.

DATES AHEAD.

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June 21-23.

Association of Railway Telegraph Superintendents. Next meeting, Detroit, Mich., June 23.

American Institute of Electrical Engineers. Annual convention, Thousand Islands, N. Y., June 28.

Ohio Electric Light Association. Annual convention, Toledo, July 13-15.

National Electrical Contractors' Association. Annual convention, Toledo, Ohio, July 21-23.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

International Municipal Electricians' Association. Convention, Atlantic City, N. J., August.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) June 8, 1909.

923,833. CUT-OFF FOR BARREL-FILLING MACHINES. William A. Hardwick, Memphis, Tenn., assignor of one-half to Richmond L. Graves, Memphis, Tenn. Filed October 2, 1908. A latch which holds a valve in open position against a spring is electromagnetically released.

923,839. MEANS FOR CONTROLLING THE SUPPLY OF ELECTRIC CURRENTS. George Henry, Lennoxville, Quebec, Canada. Filed February 2, 1907. A thermo-expansive wire controls the opening and closing of the circuit.

923,864. PROCESS FOR THE ELECTRIC DISSOCIATION OF METALS BY THE WET METHOD. Alfred Levy, Paris, France. Filed February 3, 1908. Describes an electrolytic process of cleaning metal articles and subsequently coating them with metal, by the use of a bath consisting of an alkali solution containing a metallic salt, and using as the anode a quantity of the metal with which the article is to be coated.

923,874. RELAY. Edward McClintock, St. Paul, Minn., assignor to McClintock Manufacturing Company, St. Paul, Minn. Filed April 30, 1907. The relay circuit, when closed, operates a circuit-closer consisting of a hollow rocking ring, containing a conducting agent, and having terminals, and means are provided for locking the circuit-closer to prevent opening of the signal circuit for a predetermined period after the opening of the relay circuit.

923,877. CIRCUIT FOR COIN-COLLECTORS. James L. McQuarrie, Chicago, Ill., assignor to Western Electric Company. Filed February 13, 1906. In a telephone system, an electromagnet controlling the operation of a coin-operated device at the subscriber's station, is supplied with current when the subscriber hangs up the receiver.

923,882. ATTACHMENT FOR TELEPHONES. Richard E. Pedigo, Chariton, Iowa. Filed July 13, 1908. A condenser housed in a suitable casing is arranged to be coupled up in series with a telephone receiver.

923,887. ELECTRICAL ROSETTE. Clarence D. Platt, Bridgeport, Conn. Filed November 28, 1908. Is devised so that the cap and base may be assembled and separated solely by a rotative movement of the cap.

923,889. CONDENSER. Albert Pruessman, Chicago, Ill., assignor to Western Electric Company. Filed April 1, 1907. Describes a process of making condensers which consists in assembling strips of plates and dielectrics into a cylindrical row, and applying pressure upon the four sides of the row so as to compress it into a prism of approximately square cross-section.

923,901. ELECTRIC RAILWAY-SIGNAL. William A. D. Short, Chicago, Ill., assignor to Continental Signal Company. Filed September 6, 1907. Comprises a signal-operating shaft, driving means therefor (including an electrically-controlled clutch), an electrically-controlled brake, and a circuit controller operating in synchronism with the shaft, and controlling the clutch and brake.

923,913. ELECTROPNEUMATIC TOOL. William Z. Ward, Syracuse, N. Y., assignor to the Pneumelectric Machine Company. Filed May 29, 1908. An electrically-actuated machine has means for ventilating the vertical motor.

923,929. ELECTRIC IGNITING DEVICE FOR REVERSIBLE INTERNAL-COMBUSTION ENGINES. Carl W. Askling, Söderhamn, Sweden. Filed October 10, 1907. A switch in the ignition circuit adjusts a circuit-closing means for this circuit, and a switch in the second circuit is controlled by the speed of the engine and shunted to the other switch.

923,933. DISTRIBUTING-TERMINAL FOR TELEPHONE-CABLES. Frank J. Beaucond, New Albany, Ind., assignor to Southern Indiana Electrical Company. Filed November 20, 1907. An electrical terminal apparatus comprises a supporting bracket, a box on this bracket for the terminal ends of the wires of a lead-covered cable, and clamping blocks also on the bracket provided with a lining of adhesive compound for holding a lead-covered cable.

923,949. ELECTROMAGNETIC SIGNAL-CONTROLLING DEVICE. Edward B. Craft, Chicago, Ill., assignor to Western Electric Company. Filed September 10, 1906. Contact springs are operated by the (second) armature (of an electromagnet) responsive to the attractive force of a magnetic extension from the magnet core (but magnetically separated from it) upon an increase of current in the electromagnet.

923,962. WIRELESS TELEGRAPHY. Reginald A. Fessenden, Washington, D. C. Filed December 31, 1906. The commutator is adapted to connect the antenna alternately with the receiving and sending devices with a periodicity above the limits of audition.

923,963. WIRELESS TELEGRAPHY. Reginald A. Fessenden, Washington, D. C. Filed January 9, 1907. The spark gap is between water-cooled terminals having thin metal walls, and enclosed in an atmosphere consisting of a vapor or gas of the argon and helium group of elements, the pressure of which can be regulated at will.

923,973. ELECTRIC-MOTOR CONTROL. Dugald C. Jackson, Madison, Wis., assignor to Dugald C. Jackson and William B. Jackson, Madison, Wis., a copartnership. Filed April 14, 1906. Electromagnets are connected with a main circuit through branch circuits and upon the closure of a switch in the main circuit are successively energized, and a normally ineffective electromagnetic mechanism in the main circuit is adapted upon excessive current flow through the main circuit to change the branch circuits to cause the electromagnets to become successively disengaged from the main circuit in a reverse order.

923,993. TELEPHONE-EXCHANGE SYSTEM. James L. McQuarrie, Oak Park, Ill., assignor to Western Electric Company. Filed September 15, 1906. A separate signal is provided for each connecting circuit, and means for displaying the signal of any connecting circuit only during the interval the telephone set is connected thereto.

924,030. TELEPHONE-RINGER. Jules A. Birsfield, Chicago, Ill., assignor to Alfred Stromberg, Chicago, Ill. Filed November 20, 1906. Has a combined gong yoke and tapper guard, consisting of three arms, two of these arms rising and supporting gongs and the third rising between the supported gongs and forming a covering for the tapper between the gongs.

924,032. ELECTROSTATIC SEPARATING PROCESS. Lucien I. Blake, Lawrence, and Lawrence N. Morscher, Neodesha, Kan.,

assignors to Blake Mining and Milling Company. Filed March 17, 1906. The process consists in bringing particles into contact and giving them diverse initial electrostatic charges depending upon their composition, in projecting the particles through a fluid medium, and in acting upon the particles by an electrostatic field to deflect them in proportion to their composition and initial charges.

924,040. ELECTRIC-LIGHT BATH APPLIANCE. Emmons Collins, Chicago, Ill. Filed March 5, 1908. The arched reflector has transverse ribs underlying it and longitudinal slats overlying it, the electric lamps being carried on the under side of the reflector and supporting legs pivoted to the apparatus and adapted to be moved into position parallel with the length of it.

924,058. CALCULATING DEVICE FOR ELECTRICAL DATA, ETC. Louis E. Graves, Los Angeles, Cal. Filed November 25, 1907. Has a revolving disk pivoted on a base member.

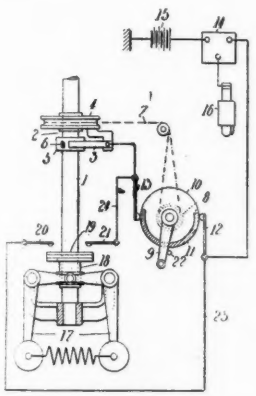
924,072. MOUTHPIECE FOR TELEPHONE-TRANSMITTERS. Milton S. Hufschmidt, San Francisco, and Charles F. Wagner, Oakland, Cal.; said Wagner assignor to said Hufschmidt. Filed November 10, 1908. Has a porous body adapted to absorb a disinfecting liquid, and a nonporous coating covering the surfaces of the body excepting the portion thereof of a relatively small area which is left exposed.

924,126. ELECTRICALLY-CONTROLLED LOCK. Alexandre Armel and Charles M. Legrand, Paris, France, assignors to Société Ch. Legrand et Cie., Paris, France. Filed March 26, 1908. The electromagnet armature engages one end of a lever the other end of which actuates a rotary catch-bolt which has a notch gearing to a greater or less extent with a locking bolt.

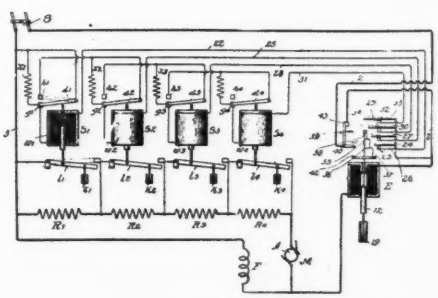
924,168. WIRELESS SIGNALING SYSTEM. Guglielmo Marconi, London, England, assignor to Marconi Wireless Telegraph Company of America. Filed November 27, 1905. The antenna at the transmitting station is disposed parallel with the surface of the earth, the horizontal position of the antenna being coincident with the line of direction to a receiving station, and means are provided the terminals of which are connected with earth and with an end of the antenna nearer the distant station, for impressing upon the antenna electrical oscillations of high frequency.

924,180. ELECTRIC BELL. William J. Murray, Leavenworth, Kan., assignor of one-twentieth to Herbert W. Wolcott, Leavenworth, Kan. Filed September 3, 1907. The clapper is withdrawn by gravity from contact with the gong.

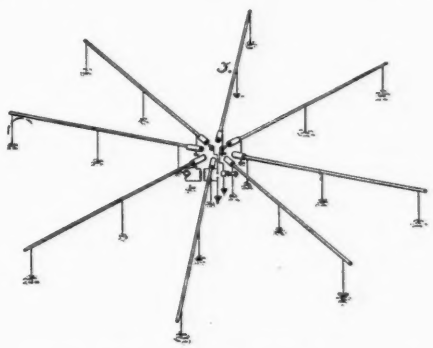
924,195. ELECTRIC-POWER HAMMER. Walter Scribner, Columbus, Ohio. Filed January 22, 1908. Similarly wound solenoid magnet coils are arranged one above the other and so connected as to form a divisible solenoid magnet, the core of which is the magnetic portion of the hammer stem.



923,929.—IGNITER FOR REVERSIBLE INTERNAL-COMBUSTION ENGINES.



923,973.—ELECTRIC-MOTOR CONTROL.



924,168.—WIRELESS SIGNALING SYSTEM.

924,092. ELECTRIC CUT-OUT. Thomas E. Murray, New York, N. Y. Filed April 13, 1908. Is provided with a locking device to prevent rotation of the threaded fuse plug to remove it from the socket.

924,093. ELECTRIC-FUSE CASE. Thomas E. Murray, New York, N. Y. Filed September 28, 1908. A tubular fuse case formed of a single piece of fictile material closed at its upper end and having a circumferential flange, has a screw-threaded portion below the flange, a threaded metal sleeve on this, a contact plate within the case, and on the closed end of it, and a conducting strip extending from the plate through the wall of the case below the flange and secured to the sleeve.

924,095. THERMOSTAT-CONTROLLER. James McCartin, Brooklyn, N. Y. Filed January 29, 1909. A thermally sensitive compound metallic bar is adapted to engage at its free end with a movable member, and electromagnetically operative means are provided for pressing the movable member against the bar.

924,109. ELECTRIC TEMPERING FURNACE. Vernon Royle, Paterson, N. J. Filed August 24, 1906. A vertical retort is electrically heated and means are provided for passing a tool into and out of the retort by gravity.

924,119. AUTOMATIC IGNITION-REGULATOR. Earl D. Waldron, Folsom, Cal., assignor of one-half to Eugene G. Palmer, Folsom, Cal. Filed November 14, 1907. A circuit-closing box carried on ball bearings on the driven shaft of an internal-combustion engine has a series of plugs carrying slotted pins, rollers in the slots of the pins, and a pin passing through each slotted pin and a guide for keeping the slotted pin from rotating. A governor is carried by the shaft, and an arm secured to the governor and to the circuit-closing box is adapted to advance the spark as the speed of the engine increases, and manual means are provided for advancing and retarding the spark at will.

924,123. CIRCUIT-CLOSER. Herbert C. Williamson, Worcester, Mass. Filed June 21, 1906. A rotary contact shaft concentrically journaled in a supporting plate is provided with a contact arm having its edge radially disposed with reference to its center of rotation.

924,227. RAILWAY-SIGNAL-OPERATING DEVICE. Arthur S. Hickley, Manasquan, N. J. Filed April 24, 1908. Describes the details of an electrically-operated signaling device.

924,260. SHADE AND SOCKET HOLDER. William F. Minor, New York, N. Y., and Carl W. W. Heck, East Orange, N. J., assignors to National Electric Lamp Company. Filed July 30, 1908. Two clamping rings with beveled edges lock a circular series of spring members about a socket and a shade.

924,261. SHADE AND SOCKET HOLDER. William F. Minor, New York, N. Y., and Carl W. W. Heck, East Orange, N. J., assignors to National Electric Lamp Company. Filed November 11, 1908. Similar to the last.

924,289. ELECTROLIER AND REFLECTOR THEREFOR. William H. Spencer, Brooklyn, N. Y., assignor to George Frink Spencer, Newark, N. J. Filed June 11, 1908. Has a lamp-socket supporting means comprising an upper and a lower shell-like section.

924,295. ELECTROLIER-SWITCH. Charles Tomschik, New York, N. Y. Filed June 26, 1908. A detent mechanism holds a wheel having a main contact face in positions corresponding to contact pins.

924,312. GUARD FOR LAMP-BULBS. George L. Brisbin, Buffalo, N. Y. Filed October 20, 1908. Inwardly projecting resilient members on a ring engage the ends of the socket and the end portion of the bulb, and fingers on the ring project toward the enlarged end of the bulb and engage the side of the bulb, and guard bars extend from the ring and protect the bulb.

924,403. SIGNAL. Daniel B. Utt, Newcastle, Ind. Filed May 12, 1908. Describes a semaphore and lamp-signaling device for electric railways.

924,416. MOTOR-OPERATED SIGN APPARATUS. Charles Beile, New York, N. Y. Filed December 7, 1907. The signs are wound on spring rollers actuated by chain and sprocket-wheel devices operated by an electric motor.

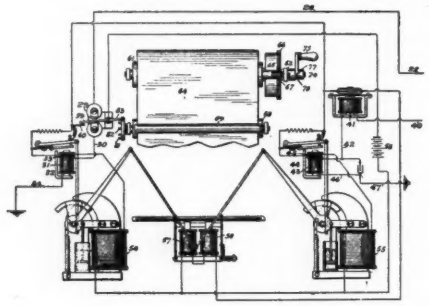
924,441. ELECTRIC WATCHMAN'S CLOCK. George B. Fessenden, Boston, Mass., assignor to Eco Magneto Clock Company. Filed November 9, 1908. A return bar passing over all of a

number of electrically-operated armature bars is adapted to return the armature bars automatically to their original position after their actuation.

924,463. CONTROLLER-OPERATING HANDLE FOR ELECTRIC CARS. Emil K. Hofmann, Andover, Mass. Filed April 8, 1909. When the handle is swung down to its lowest point the jaws of a clamp pivotally sustained by the handle are held tightly against the controller shaft, and when it is swung up the jaws release the controller shaft.

924,481. PASSENGER-REGISTERING DEVICE FOR CARS. Walter S. Lytle, Philadelphia, Pa. Filed June 26, 1908. The registering device is electrically actuated, and the contact-carrying element controlling the electric current can be moved step by step in one direction, locked and released.

924,499. THERMOSTATIC CIRCUIT-CONTROLLER. Harvey F. Rice, Espy, Pa. Filed July 25, 1908. Describes the details of a thermostatically-actuated circuit-controller.



924,512.—TELAUTOGRAPH.

924,512. TELAUTOGRAPH. George S. Tiffany, Summit, N. J., assignor to the Gray National Telautograph Company. Original application filed July 6, 1906. Divided and this application filed May 16, 1907. Renewed April 28, 1909. A spring-actuated reel normally tends to wind up the recording paper strip of the receiving instrument and draw it over the writing field, and is retarded by a device comprising two rotative members engaging opposite sides of the paper and normally resisting the movement of it, this retarding device being provided with an escapement controlled by a magnet in the main line circuit.

924,560. WIRELESS SIGNALING SYSTEM. Guglielmo Marconi, London, England, assignor to Marconi Wireless Telegraph Company of America. Original application filed November 27, 1905. Divided and this application filed August 9, 1906. An antenna for a wireless signaling system comprises a conductor consisting of two parts supported parallel to the surface of the earth and suitable electrical instruments or apparatus connected between its parts, the length of this conductor being substantially equal to one-fourth, or its multiple, of a wave length of the oscillations impressed upon it, and the conductor being situated in a vertical plane coincident with that passing through a distant station.

924,573. BATTERY AND HOLDER THEREFOR. George L. Patterson, New York, N. Y., assignor to Alice C. Patterson, New York, N. Y. Filed May 26, 1908. Describes connections, etc., for a battery and holder.

924,574. BATTERY AND HOLDER. George L. Patterson, New York, N. Y., assignor to Alice C. Patterson, New York, N. Y. Filed May 26, 1908. Similar to the last.

924,575. BATTERY. George L. Patterson, New York, and George H. Hopper, Brooklyn, N. Y., assignors to Alice C. Patterson, New York, N. Y. Filed October 16, 1908. Describes connections for a dry battery.

924,576. BATTERY-BOX TERMINAL CONNECTION. George L. Patterson, New York, N. Y., assignor to Alice C. Patterson, New York, N. Y. Filed December 1, 1908. Has means for automatically connecting the terminals of a carrier with the terminals of the box.

924,577. BATTERY BOX AND HOLDER. George L. Patterson, New York, N. Y., assignor to Alice C. Patterson, New York, N. Y. Filed December 1, 1908. A battery carrier is adapted to the interior of a box and removable therefrom, and terminals carried by the box have extensions in electrical communication with the cover-holding means and a binding-post arranged to make electrical connection with the terminal through the cover-holding means.

924,601. ELECTRIC FAN. Frederick Diehl and Adolph F. Becker, Elizabeth, N. J., assignors to Diehl Manufacturing Company. Filed May 11, 1908. Describes a form of swiveling electric fan.

924,603. ELECTRIC FURNACE. Louis D. Farnsworth, Palo Alto, and Max J. Bartell, San Francisco, Cal. Filed April 3, 1908. The electrodes and crucible are arranged so that the current between the electrodes will pass downwardly through a body of slag and thence across through the molten metal in the crucible, and a supplemental chamber is provided on one side of the crucible and in open connection with it, into which the molten metal will freely flow.

924,609. ROTARY SNAP-SWITCH. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company. Filed January 3, 1908. Describes the details of a form of rotary snap switch.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired June 14, 1909:

476,776. ELECTRIC RAILWAY. Richard W. Barkley, Brooklyn, N. Y.

476,781. ELECTRIC SWITCH. Francis Broadnax, New York, N. Y.

476,792. ELECTRIC SWITCH. William M. Goodridge, Highland Park, Ill.

476,793. METALLIC CIRCUIT HOUSE-TELEPHONE SYSTEM. William M. Goodridge, Highland Park, Ill.

476,818. MAGNETIC INDUCTOR FOR DYNAMO-ELECTRIC MACHINES. Lazarus S. M. Pyke and Edward S. Harris, London, England.

476,826. TELEPHONE-EXCHANGE APPARATUS. John A. Seeley, Brooklyn, N. Y.

476,829. ELECTRIC SWITCH. Albert P. Seymour, Syracuse, N. Y.

476,830. COMPENSATING ALTERNATING-CURRENT DYNAMO. Oliver B. Shallenberger, Rochester, N. Y.

476,843. CURRENT ALTERNATOR. Harry L. Tyler, Corning, N. Y.

476,845. LIMITING STOP FOR ARMATURES. Richard Varley, Jr., Englewood, N. J.

476,855. LIGHTNING ARRESTER. Alexander Wurts, Pittsburg, Pa.

476,873. ELECTRIC TRAIN SIGNAL. Nathaniel B. Cregier, Chicago, Ill.

476,887. TELEPHONE SYSTEM. Belizaire Marinovitch and Geza Szarvady, Paris, France.

476,889. POLE FOR ELECTRIC WIRES. Julius Meyer, New York, N. Y., and Carl Binder, Chicago, Ill.

476,933. SPARK ARRESTER FOR ELECTRIC LAMPS. Walter M. Spencer, Chicago, Ill.

476,935. ELECTRIC RAILWAY. Charles P. Tatro, Spokane, Wash.

476,983. PYROMAGNETIC GENERATOR. Thomas A. Edison, Llewellyn Park, N. J.

476,986. MEANS FOR PROPELLING ELECTRIC CARS. Thomas A. Edison, Llewellyn Park, N. J.

476,987. ELECTRIC LOCOMOTIVE. Thomas A. Edison, Llewellyn Park, N. J.

476,988. LIGHTNING ARRESTER. Thomas A. Edison, Llewellyn Park, N. J.

476,989. CONDUCTOR FOR ELECTRIC RAILWAYS. Thomas A. Edison, Llewellyn Park, N. J.

476,992. INCANDESCENT ELECTRIC LAMP. Thomas A. Edison, Llewellyn Park, N. J.

476,993. ELECTRIC ARC LAMP. Thomas A. Edison, Llewellyn Park, N. J.

477,049. ELECTRIC CLOCK SYNCHRONIZER. James W. Du Laney and Charles F. Du Laney, Canton, Ohio.

477,068. FIRE-ALARM SYSTEM. Lewis G. Rowland, Camden, N. J.

477,070. FIRE-ALARM SYSTEM. Lewis G. Rowland, Camden, N. J.

477,071. ANNUNCIATOR. Lewis G. Rowland, Camden, N. J.

477,101. ELECTRIC WELDING. Charles L. Coffin, Detroit, Mich.

477,146. ELECTRIC LAMP-SOCKET SWITCH. Gwynne E. Painter, Baltimore, Md.

477,182. SECONDARY BATTERY. Henry H. Lloyd, Philadelphia, Pa.